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Fiscal Policy Space and Economic Performance: Some Stylized Facts♣

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Summary

This paper complements the cross-country approach by examining the correlates of GDP per capita growth acceleration around "significant" public expenditure episodes by reorganizing the data around turning points, or "events". Here we define (i) a *growth event* as an increase in average per capita growth of at least 2 percentage points (pp) sustained for 5 years, (ii) *fiscal event* as an increase in the primary fiscal expenditure annual growth rate of approximately 1 pp sustained for 5 years and not accompanied by an aggravation of the fiscal deficit beyond 2% of GDP. These definitions of events are applied to database of 140 countries (118 developing countries) over 1972-2005, providing a summary but encompassing description of "what is in the data".

For this sample, the probability of occurrence of a fiscal event is about 10%, and, for a large range of parameter values for the selection of a "significant" event, the probability of a growth event once a fiscal event had occurred is in the 22%- 28% range. The probability of occurrence of a fiscal event is higher for the bottom half of the income distribution of countries, but the probability that this fiscal event is followed by a growth event is higher for the third quartile, corresponding to middle income countries (which are largely in Latin America). The probability of a fiscal event *not* followed by a growth event is significantly higher for the Middle East and Africa region.

The description of the changes in expenditures components during fiscal events shows that, for developing countries, there are notable differences underlying fiscal events followed by growth events: they occur under situations of (i) significant lesser deficit, (ii) fewer resources devoted to non-interest General Public Services and (iii) shift in discretionary expenditures towards Transport & Communication.

After controlling for the growth-inducing effects of positive terms-of-trade shocks and of trade liberalization reform, probit estimates indicate that a growth event is more likely to occur in a developing country when surrounded by a fiscal event. Moreover, the probability of occurrence of a growth event in the years following a fiscal event is greater the lower is the associated fiscal deficit, confirming that success of a growth-oriented fiscal expenditure reform hinges on a stabilized macroeconomic environment (through limited primary fiscal deficit).

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1. INTRODUCTION

As detailed in World Bank (2007), a renewed focus on fiscal policy and growth has spawned a lively debate over demands for greater "fiscal space" to support growth.[1] However, there is considerable controversy on what a suitable fiscal policy package should look like. Is there a trade-off between the objective of short-term stabilization and long-run growth? Currently, the debate over fiscal policy is cast in terms of "fiscal space" (i.e. availability of a budgetary room to spend more on infrastructure and education for example) and sometimes "macroeconomic space" (possibility to the government to increase expenditure without impairing macroeconomic stability), see Perotti (2007).

As proposed in the recent report to the Development Committee, a growth and development oriented fiscal policy must take into account the composition and efficiency of public expenditures in a framework that includes country's conditions (level of indebtedness, and other idiosyncratic characteristics like its access to international financial markets or, in the case of poor countries, to aid). Under this definition, the term "fiscal space" thus refers to a government's ability to undertake spending to enhance economic growth without impairing its present and future ability to service its debt. [2]

So far the exploration of fiscal space and performance has proceeded along three different paths: (i) case studies such as those in the Development Committee report where the performance of 12 countries with different fiscal/development profiles are contrasted and the complementary high-growth case studies for six countries presented to the Development Committee Meeting of March 2007 (see World Bank, 2007, and Biletska and Rajaram, 2007); (ii) studies of the efficiency of specific public sector expenditures - e.g. the several studies on infrastructure (Calderon and Serven, 2003, 2004, 2005) or on other components of social infrastructure (Estache, Gonzales, and Trujillo, 2007), and (iii) cross-country growth regressions (see the exhaustive summary proposed in Annex 2 of the report for the Development Committee, World Bank, 2007, or

[1] As defined in the World Bank interim report (2006, p. 1), "*the term* [fiscal space] *initially applied to the view that fiscal deficit targets limited the ability of government to borrow to finance productive, growth-enhancing infrastructure projects. The term has now gained wider currency, however, and can be seen to refer to constraints to public expenditure which have the potential to raise productivity and yield returns in the future* [...]".

[2] Depending on individual circumstances, creating fiscal space can occur by increasing borrowing and/or raising revenue mobilization, improving the efficiency of public expenditure, and mobilizing more grant aid. The "fiscal space diamonds" used in the interim Report (see World Bank, 2006) is a way to visualize differences across countries. The "diamond" presents the four main options (raise revenue effort; increase borrowing; increase grant aid; improve expenditure efficiency) along four axes departing from coordinates that summarize the country's current fiscal stance. While a pedagogical and informative way to indicate how fiscal space may be created, this heuristic is not made easily operational.

Perotti, 2007, section 4) in which government expenditures are included among the regressors.

This paper complements the cross-country approach by examining the correlates between significant public spending "chocs" and growth accelerations, reorganizing the data around turning points, or "events" (calendar time is transformed into "event time") [3] . Does a fiscal "event" precede a growth "event"? What are the characteristics of such a fiscal event?

We look for "events" in growth along the lines of Hausman, Pritchett and Rodrik (2005). Lacking information on milestone events in fiscal reforms similar to those available for trade reforms as in Wacziarg and Welch (2003), we define an "event" on the fiscal side using a approach similar to the definition of an event on the growth side, i.e. we define a "fiscal event" based on conditional changes in primary fiscal expenditures.

As explained in the body of the paper, this descriptive analysis faces several challenges. First, as already mentioned, in spite of its focus on growth, the approach certainly captures the stabilization effects of fiscal policy. Actually, our data-constrained definition of fiscal event is based on primary spending that includes also non-discretionary spending. Second, there is arbitrariness in our parameterization of fiscal event, implying a careful sensitivity analysis. Third, the investigation could be viewed as an exploration of the correlates of primary spending choc and growth acceleration and extra care should be exercised when interpreting the results.

Keeping these caveats in mind, the paper unfolds as follows. In section 2, we discuss the relevance of using an event methodology approach and summarize some of our main findings. Section 3 presents the identification conditions of both growth and fiscal events (with details and sensitivity analysis left to the annex A.3). Section 4 studies the characteristics of growth and fiscal events, and the relation between the two. The descriptive analysis computes fiscal event (unconditional) probabilities and probabilities that fiscal events are followed (or not) by growth events. Section 5 investigate the characteristics of fiscal events, in particular the ones followed by a growth event, in terms of geography, underlying changes in expenditure composition, and in the level of associated primary deficit. Then the statistical analysis turns on the growth side, the objective being to see if, based on probit estimates, growth events are more likely to occur in a developing country when surrounded by a fiscal event.

[3] The "events methodology" approach has been used in several areas, notably by Bruno and Easterly (1998) for inflation, Wacziarg and Welch (2003) for trade liberalization, and Hausman, Pritchett and Rodrik (2005) for growth and investment performance.

2. THE EVENTS METHODOLOGY

Cross-section growth studies have identified that some public expenditures tend to be "productive" in the sense of being growth-enhancing. In the "standard growth regression" framework, average GDP per capita growth over a decade or more is regressed on a set of "standard" control variables augmented by the inclusion of public expenditure variables.[4] From the perspective of this study, among the more interesting recent developments in these exercises, Kneller *et al.*, 2000, Bose *et al.*, 2003, and Adam and Bevan, 2005, using dynamic panel, have argued persuasively that one should take into account both the sources and the uses of funds *simultaneously*. Taken together, these recent cross-country studies find that capital expenditure, as well as spending on education, health, transport and communication can be favorable to growth when the government budget constraint is taken into account (see World Bank, 2007 - Annex 2). We retain from these studies that any analysis of fiscal performance should incorporate the government budget constraint to provide for a meaningful evaluation of the correlates of public expenditures and its relation with growth.

Moreover, as pointed out in several studies (e.g. Easterly et al., 1993), growth tends to be highly instable in low-income countries. This makes it more difficult to unveil the relation between growth and its fundamentals. Moreover, as noted by Hausmann, Pritchett and Rodrick (2005) "*standard growth theory, whether of the neoclassical or the endogenous variant, suggests that our best bet for uncovering the relation between growth and its fundamentals is to look for instances where trend growth experiences a clear shift*. [...] *If instead we lumped together data on growth without paying attention in these turning points, we would be averaging out the most interesting variation in the data*."

Here we focus on events that are restricted to GDP growth and primary spending growth *acceleration* (an increase in annual GDP per capita growth of at least 2 percentage points and sustained for at least 5 years and on the fiscal side to an increase in primary fiscal expenditure). Rather the fiscal event captures a change in fiscal stance that likely includes a discretionary component that meets certain qualifications seeking to exclude increases in fiscal expenditures that could be destabilizing.

As a point of departure, an "events" methodology is purely descriptive. It approaches the robustness problem of the correlates between growth and fiscal expenditures by focusing on turning points in the data, the turning points being defined at discretion. Using threshold values to define events is also a way to

[4] Perotti (2007) reviews critically the contributions of the production function and growth regressions emphasizing that the endogeneity of public investment combined with the lack of good instruments casts doubts on the robustness of the results. These criticisms apply to the events methodology as well when interpreting results.

control for some of the fluctuations in the data and to isolate what is under study in a more systematic way than, say, in case studies, since the selection is over a large sample. Actually, we identify fiscal events over the largest possible database including government spending. Moreover, we define conditions on fiscal event in order to take into account the government budget constraint: to qualify as an event, we impose that the increase in fiscal expenditure growth does not occur at the expense of the fiscal deficit.

In sum, while the interpretation of results is subject to caution, this approach provides an easy-to-understand exploration of the correlates between fiscal policy (here fiscal expenditures) and performance (here per capita GDP growth), without imposing a single common linear model for all countries as done in cross-countries regressions. When applied to a large database, as is done in this study, it gives a more encompassing description of "what is in the data" and is thus complementary to the three other approaches mentioned above.

The descriptive analysis computes fiscal event (unconditional) probabilities and probabilities that fiscal events are followed (or not) by growth events. The description of the changes in expenditures during fiscal events shows a shift away from Defense, non-interest general expenditure and Transport & Communication expenditures towards education, health and Housing & Community expenditures. For the developing country group, there are notable differences in the evolution of expenditures for fiscal events followed by growth events: first fiscal events followed by growth events occur under situations of a significant lesser deficit, and a shift in discretionary expenditures towards transport & communication is only observed for fiscal events followed by growth events. After controlling for the growth-inducing effects of positive terms-of-trade shocks and of trade liberalization reform, the statistical analysis in which the probability of a growth event is conditioned on the occurrence of a fiscal event in surrounding years confirms that growth events are, on average, more likely when a fiscal event has occurred. Moreover, the probability of occurrence of a growth event in the five years following a fiscal event is greater the lower is the associated fiscal deficit, confirming that success of a growth-oriented fiscal-expenditure package likely hinges on a stabilized macroeconomic environment (through limited fiscal deficit).

3. DEFINING EVENTS

We are interested in the relation between a "significant" change in fiscal spending and a "significant" change in GDP growth - what Hausmann, Pritchett and Rodrick (henceforth HPR, 2005), call "growth acceleration". Per capita GDP *growth* and primary fiscal expenditures (in GDP %) *growth* are then our two indicator values. Call these growth indicators, z. Average annual *changes*, $z_{t,n}$, are computed for each year over successive windows of length n. Here, because of the limited sample size for the fiscal data (1972 to 2005) we choose a succession of windows of $n = 5$ years. So we compute $\Delta z_{t,n}$:

$$\Delta z_{t,n} = z_{t,t+n} - z_{t,t-n}$$

If the change $\Delta z_{t,n}$ in the average indicator value satisfies certain conditions (see below), we will say that an "event" has taken place for z in t. The annexes A.1 and A.1 describes in detail the sample and annex A.3 reports how we selected the parameter values defining an event and how sensitive our sample of events is to changes in the conditioning values. Here we summarize the conditions for our 'benchmark' set of parameters starting with GDP per capita growth, and then turning to primary fiscal expenditures. In this benchmark case, the sample produces 58 growth events and 95 growth events. Sensitivity of the number of events to the choice of parameter values is reported in the annex A.3, table A.4.

Growth events. A growth event will have taken place in *t* if the following conditions are met:

(i) an increase in the average per-capita growth of 2 ppa or more (percentage points per annum, ppa),
(ii) growth acceleration sustained for at least 5 years *[t;t+4]*,
(iii) an average annual growth rate at least 3.5 ppa during the acceleration period *[t;t+4],*
(iv) a post-acceleration output exceeding the pre-episode peak level of GDP.

With this selection process, several events could follow one another over consecutive years capturing in fact the same event. To select the more "relevant" year, we fit a spline regression and choose the year for which the change in indicator value is statistically the most significant. Finally, we impose the restriction that two events must be separated by at least five years. This method is used for both growth and fiscal events.

Here, we strictly follow HPR in their definition of growth acceleration. However, since there is considerable variation in growth performance associated with terms-of-trade changes, especially for low-income countries (see Easterly et al. 1993), one might also wish to refine the definition of a growth event to purge

from the series the growth accelerations that would be due to changes in the terms-of-trade.[5] This is done in the statistical analysis of section 5 where we control for the impact of changes in the terms-of-trade.

Fiscal Events. The core of this study is the definition of a fiscal event. Ideally, we would like to carry out the equivalent of what Wacziarg and Welch (WW, 2003) have done for trade liberalization episodes, that is use a combination of criteria that qualify a fiscal reform to center an event which could then be checked against detailed reports identifying significant changes in the fiscal regime. In a second step a "before and after" analysis would be carried out around the fiscal event for selected outcome indicators (e.g. growth and other indicators like investment in the case of WW).

Unfortunately, carrying out a similar exercise for changes in fiscal policy is much more difficult. First, as mentioned above, is the issue of trying to disentangle the stabilization objective from the growth objective which is not addressed here. Second, there is much more fungibility in fiscal policy than in trade policy, so it is more difficult to identify the fiscal space levers, and it is much more difficult to identify the expected effects of changes in these levers. Here, we restrict fiscal reform to a change in total primary fiscal expenditures and, in a second step, we study the underlying evolution of many components of potential interest (e.g. education, health or transport and communication)

Faced with these limitations and with limited data availability, we rely on changes in consolidated central government total fiscal expenditures, TFE (taken from the GFS, see details in annex A.1) as "event" changes in government expenditures. Since we are looking for autonomous fiscal expenditures, events are defined on expenditures purged of non-discretionary components such as wages and interest payments, IP.[6] Lacking information on the wage component for each functional expenditure category, we consider as discretionary TFE purged of interest payments. So, we define discretionary fiscal expenditure, DFE, as $DFE = TFE - IP$ which is equivalent to focusing on primary spending. We also compute the primary fiscal deficit, *def,* as the difference between the total revenues and *grants* and the discretionary fiscal expenditure, DFE (so a deficit is negative).

As discussed below, for the developing countries in the sample used here, average DFE is 24% of GDP and average central government primary fiscal

[5] While HPR also face this problem, because they use an 8-year (rather than a 5-year) window, they are less likely to be capturing terms-of-trade fluctuations in their growth events.
[6] Heller (2006) considers wages and interest payments as the 2 non-discretionary expenditures in developing countries. In our fiscal data set which is decomposed by "function"‘ rather than "economic" use we do not have a wage component for each function so we cannot include wages as non-discretionary. See the annex A.1 for the definitions of these components.

deficit, *def*, is -2% of GDP. An increase in *DFE* will be declaring as fiscal event in *t* when the following conditions are met over the following five year window:

(i) an increase in DFE average growth of 1 ppa (percentage point per annum),
(ii) If in deficit (i.e *def*< -2% of GDP), deficit does not increase,
(iii) If in surplus (or in *def* > - 2% of GDP), the increase in DFE does not lead to a deficit exceeding 2% of GDP

To illustrate, suppose that, under our definition of window (i.e. regressions over 5 year periods), there was no increase in DFE over the previous period, and that DFE was equal to the sample average of 24%. Then condition (i) above will be satisfied for a country if DFE increased by at least 4 percentage points during the 5-year period, i.e. it increased to 28% of GDP. The 5-year (rather than a longer period) window was dictated by the length of the time-series and our desire to have enough fiscal and growth events for statistical analysis. Sensitivity of events to the above conditions is discussed in the annex A.3.

This is a first cut at defining a "fiscal event" and this definition could be improved upon in several ways. First, the "event" should not be interpreted as entirely discretionary (or unanticipated). The large set of expenditures included in DFE implies that the fiscal event captures non-discretionary elements in the definition and more restrictive definitions of discretionary fiscal expenditures could certainly be built around one of the functional components of fiscal expenditures, although any greater volatility in narrower series may be difficult to interpret.[7] Thus, the most plausible interpretation of the constructed "events" is as significant changes in fiscal policy and refrain from attributing any government objective to the event.

Second, in view of the links we are seeking to establish between fiscal spending events and growth events, one might consider whether the selection of the fiscal event (in particular through conditions (ii) and (iii)) is biased towards selecting as fiscal events those that are followed by growth. Actually, due to the automatic response of government spending and taxes to output growth, a period of growth acceleration after the fiscal event will lead, other things equal, to a lower deficit. Hence, by construction, we are more likely to select as fiscal events those that are followed by growth since a condition is imposed on the evolution of the fiscal deficit (conditions (ii) and (iii)). This is certainly the case for OECD countries such as Finland, Sweden or Norway that appear in our

[7] As discussed by Perotti (2007), it is very difficult even in developed countries like the US where quarterly data and external information on GDP elasticities of revenues and transfers are both available to apply time-series methodologies to detect a fiscal discretionary policy shock (i.e. an unanticipated shock) in the data. Data requirements are too demanding to apply these (controversial) time-series methodologies to developing countries.

event results (see figure 1 below) and that are known for their strong tax revenue elasticities to production (elasticities estimated to be greater than unity). However, as noted by Perotti (2007), among the papers that have studied the cyclical behavior of fiscal policy in developing countries (see e.g. Kaminsky et al., 2004, and Gavin and Perotti, 1997), it seems widely accepted that fiscal policy in these countries is typically pro-cyclical, i.e. the budget deficit is positively correlated with economic growth. [8] Hence, according to this pro-cyclical effect, if a growth event occurs in the year following a fiscal event, this should increase the deficit, and hence weaken the probability of observing fiscal events followed by a growth event (recall that an increase in discretionary fiscal expenditure associated with an increase in the fiscal deficit does not qualify as a fiscal event). One might even suspect our definition of fiscal event to underestimate, for the developing countries, the correlation with subsequent growth.

Third, even though the GFS makes an effort at classifying extra-budget items consistently, as already mentioned, data is limited to the Consolidated Central Government while a more suitable aggregate would be based on data for the Consolidated General Government.[9] Given the quality of the data, we have refrained from trying to tune the coarse constraint on deficit improvement imposed here. A natural extension would be to replace conditions (ii) and (iii) by a formal test on sustainability.[10] Finally, we would not want to exclude countries that sought fiscal space through highly confessional borrowing even if this led to an increase in their deficit (since, despite high grant percentage as a share of the loan, such loans are not treated as grants).[11] This suggests that one might wish to take an estimate of the grant component of such loans and include that portion in government revenue thereby relaxing the budgetary constraint. However, there is no data on the grant component of these loans. As an alternative, we redefined our fiscal event with a fourth condition allowing

[8] Several explanations have been advanced to explain the procyclicality of fiscal policy in developing countries. Among others, Gavin and Perotti (1997) have argued that developing countries face credit constraints that prevent them from borrowing with slow growth. Tornell and Lane (1999) show that competition for a common pool of funds among different units (ministries, provinces) leads to the so-called "voracity effect" whereby expenditure could actually exceed a given windfall. Alesina and Tabellini (2005) show that procyclicality is an optimal behavior in the presence voters with imperfect information and corrupt politicians.

[9] 86% of the observations rely on data consolidated at the central government sector level and the remainder 14% at the budget central government level. See annex A.1.3 for further discussion.

[10] Since the sensitivity analysis to the selection of parameter values reported in annex A.3 gives a relatively small change in the number of fiscal events over a broad range of parameter values, we refrained from experimenting with a formula that would link the value of the deficit level to the level of indebtedness, or from more formal tests of sustainability such as those used by Chalk and Henning (2001). Moreover these tests have only be done for OECD countries and given the lack of availability in indebtedness data, these improvements in the fiscal event definition seem hardly worth attempting in our sample.

[11] We thank Peter Heller for this suggestion.

Low-income countries to increase their fiscal deficit during the fiscal spending growth period up to 4% of GDP (considering that for low income countries, external borrowing is likely to be on highly concessional terms). Results are reported in next section.

Fourth, with better indicators of performance of government expenditures than GDP per capita growth, this "event-type" analysis could be extended directly to the indicators of fiscal expenditure that concern the debate on fiscal space, e.g. health and/or education expenditures and expenditures on transport & communication (capturing then, for instance, event in budget reallocation between government functions for a given amount of total outlays).[12]

4. Patterns of Fiscal and Growth Events

Keeping in mind the shortcomings of this methodology, we take an exhaustive approach by constructing fiscal events for as many countries as possible. Since we are interested in the various components of fiscal expenditures, the best database is the IMF Government Financial Statistics (GFS). GFS statistics are available for a large number of countries since 1972 and up to 2005.[13] Following most previous studies on fiscal expenditures we use data on fiscal expenditures by function (instead of expenditures by economic classification---i.e. by current vs. capital expenditures). As described in annex A.1, after reconciling the fiscal data, our sample includes 140 countries, of which 118 are developing (i.e. non High Income OECD countries).

Data are described in table 1 which gives decadal averages for the fiscal variables used in the study. A comparison of actual vs. potential observations indicates a large number of missing observations, even for OECD countries, especially over the period 1991-2000 where the coverage is the weakest. For developing countries, coverage gets better through time with data for half of the potential observations during the nineties. One of the reasons for the small sample (relative to the potential sample) is that we require that data be available for all the components of fiscal expenditures by function, else the year observation is entered as missing and hence excluded from the sample. This lack of data raises the question of biases for the subsequent analysis. In view of the relatively evenly spread out pattern of missing observations across the sample, and in the absence of any other information, we proceed as if there were no selection effects operating via missing data.

[12] However, as already mention, given the low quality of fiscal data, volatility in narrower series may be more difficult to interpret.

[13] There was a major change in the GFS in 1989 causing concern about the comparability of data before and after that date (see details on the data reconciliation in annex A.1.2). Using box-plots, we explored the possibility of lack of comparability for the series of interest. Fortunately, as discussed in the annex A.1.2 (see figure A1), this is not the case.

Average deficit figures are comparable across the two groups of countries. Regarding our variable of interest—primary fiscal expenditure—the figures are about a third higher for OECD industrial countries partly reflecting a larger revenue base. As defined here, there is no trend in primary expenditures for the two groups of countries over the three decades. As to the components of expenditures, developing countries spend proportionately more on general public services, on defense and on education, while OECD countries spend more on health.

Table 1: Central fiscal expenditures: average values

	1972-1980	1981-1990	1991-2000
High Income OECD countries (22)			
Observations (potential number in parenthesis)	*159 (198)*	*179 (220)*	*129 (220)*
Overall deficit in GDP %	-.90	-2.47	-1.94
Total public exp. in GDP %	29.21	35.48	33.77
Discretionary public exp. in GDP % **a/**	27.79	32.05	30.49
Expenditures by function (in % of total public exp.)	*100*	*100*	*100*
General public services of which	17.7	22.2	22.9
interest payment	*(4.9)*	*(9.7)*	*(9.7)*
Defense	8.4	6.8	5.6
Transport and Communication	6.8	5.0	3.7
Housing and community amenities	2.3	2.1	2.0
Health	9.7	10.0	10.8
Recreation, culture, and religion	0.9	0.9	1.0
Education	9.4	7.9	7.2
Others (residual)	40.0	35.5	37.1
Developing countries (118)			
Observations (potential number in parenthesis)	*360 (1062)*	*433 (1180)*	*644 (1180)*
Overall deficit in GDP %	-2.57	-2.38	-1.93
Total public exp. in GDP	23.58	26.45	25.44
Discretionary public exp. in GDP % **a/**	22.40	23.86	22.66
Expenditures by function (in % of total public exp.)	*100*	*100*	*100*
General public services of which	28.3	27.9	28.0
interest payment	*(5.0)*	*(9.8)*	*(10.9)*
Defense	12.3	11.3	10.4
Transport and Communication	9.6	8.0	5.6
Housing and community amenities	2.9	3.1	3.2
Health	6.4	6.5	6.9
Recreation, culture, and religion	1.5	1.2	1.4
Education	14.7	13.7	13.4
Others (residual)	19.3	18.4	20.1

Notes: See annex A.1.3, table A.3 for country classification in the sample.
a/ defined as total public expenditures less interest payments. See annexes A.1 and A.2 for details on definition and construction of variables.

Source: Authors' computation from GFS data. See Annex A.1.

For the growth database, we use the Penn World Table PWT 6.2 as our baseline data source.[14] Hence, the "growth" database covers 187 countries over the same period as the fiscal data base, i.e. 1972-2004. Taking into account missing data, the sample includes 5380 observations hence 87% of the potential number of observations (=6171=187 countries*33 years).

Turn now to the construction of growth and fiscal events as defined in section 3 and in the annex A.3. Due to the availability of GFS data since 1972, we have a shorter time-series than HPR. This implies that we cannot use periods as long as HPR who used GDP data going back to 1950, leading them to choose 8-year periods, i.e. $n = 7$ and giving them events over the period 1958-1992 (GDP data available until 1999). As mentioned above, due to the limitations imposed by the availability of fiscal data, we choose 5-year periods for both fiscal and growth events, i.e. $n = 4$. This means that the exercise covers the period 1977-2000. [15] Because there is missing data, we have also imposed that data be available for 4 out of the 5 years entering each "window". If this condition is not satisfied, a missing value is entered for that "window".

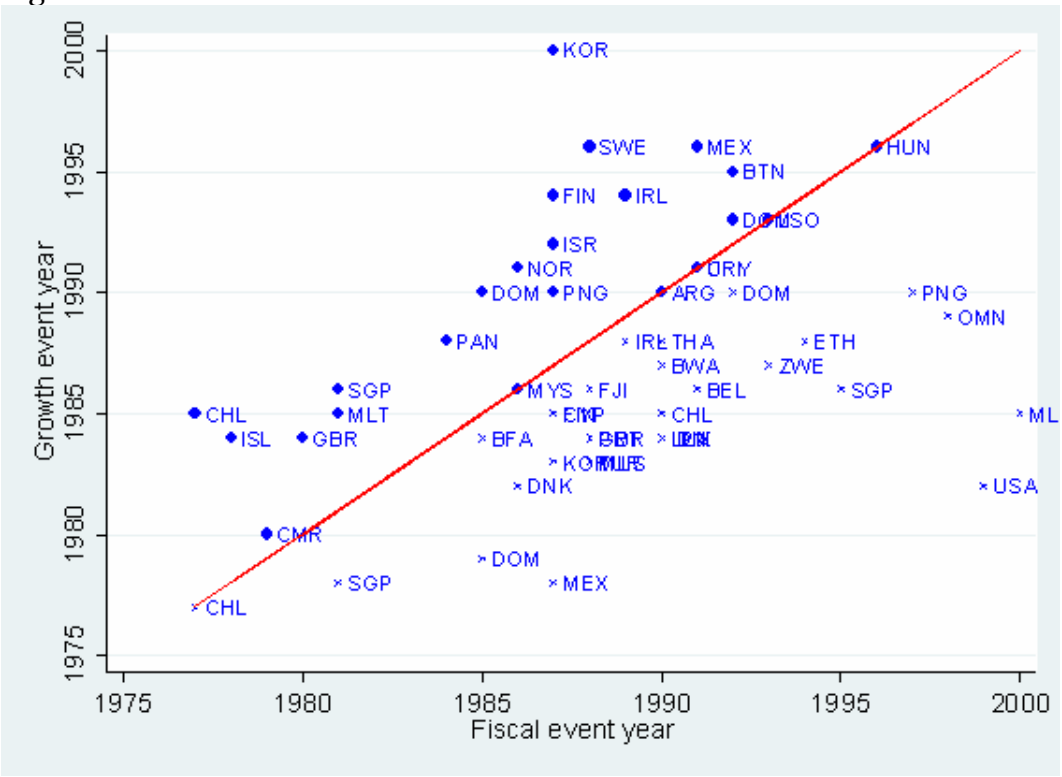
Having computed the fiscal and growth events on their respective databases, we merge the two into a final dataset (see annex A.2 for details). The resulting database includes 107 countries (84 developing countries, i.e. all non- High Income OECD countries), over 1977-2000. This leads to 1452 observations hence 57% of the potential number (=2568=107 countries*24 years).

As indicated in the annex A.3--where we carry out sensitivity analysis with respect to the selection of parameter values in defining events--for this sample and for the parameter values selected here, we get 58 growth events and 95 fiscal events (see table A.4 for the number of events obtained when we change parameter values over the sample). This is our benchmark data set over which exploration takes place. As discussed in table A.4, the number of events is relatively insensitive to a range of plausible parameter values. Nor are changes in the pattern of events surprising when we change parameter values.

Figure 1 plots a subset of events in this benchmark case: 25 fiscal events are simultaneous or followed by a growth event, 23 fiscal events are preceded by a growth event. The residual (47) events that are neither followed nor preceded by a growth event are not shown in the figure (also see the details in table A.4).

[14] Using WDI database is an alternative. However, as shown by HPR, this does not affect the results.
[15] When we define n=8 instead of 5, the period under study shrinks to 1980-1997 and we get 52 fiscal events and 18 growth events.

*F*igure 1. Growth events vs. fiscal events



Notes:
- 19 points strictly above the red line (growth event strictly preceded by fiscal event);
- 23 points strictly below the red line (growth event strictly followed by fiscal event);
- 6 points on the red line (growth event simultaneous to fiscal event, of which 4 in Latin America).

95-48=47 fiscal events with no associated growth events not shown in the figure.

ARG: Argentina; BTN: Bhutan; CHL: Chile; CMR: Cameroon; CRI: Costa Rica; DOM: Dominican Republic; FIN: Finland; GBR: United Kingdom; HUN: Hungary; IRL: Ireland; ISL: Iceland; ISR: Israel; KOR: Korea, Rep.; LSO: Lesotho; MEX: Mexico; MLT: Malta; MYS: Malaysia; NOR: Norway; PAN: Panama; PNG: Papua New Guinea; SGP: Singapore; SWE: Sweden; URY: Uruguay.

Source: Authors' computation from GFS and PWT 6.2 data.

Table 2 reports unconditional probabilities of these fiscal events.[16] For the whole sample and given our construction of a fiscal event, the probability of occurrence of a fiscal event is 9.7% and the probability of a growth event once a fiscal event has occurred is 26.3%. Table 2 also reports probabilities across countries ranked according to their income per capita and by region). Column 5 shows that, although the probability of occurrence of a fiscal event is fairly evenly spread across the income quartiles, the probability is higher for the lower quartiles (first and second). It is difficult to interpret this pattern since, as explained above, this definition of a fiscal event does not distinguish between fiscal policy shocks and systematic fiscal policy. If one can assume that fiscal policy shocks are not more prevalent among low and middle income countries, then the pattern would seem to indicate that fiscal policy is more volatile among low-income countries. The probability that a fiscal event is followed by a growth event is much higher for the third quartile (i.e. for middle-income countries which are largely in Latin America). Note however, that the patterns suggest that fiscal policy may be pro-cyclical (but not destabilizing given our definition of fiscal event) in Latin America since, out of the 9 fiscal events associated with growth in Latin America, 4 are simultaneous (see figure 1), which seems to confirm earlier results (see e.g. Gavin and Perotti, 1997, Kaminsky et al. 2004 and Perotti, 2007).

The bottom part of table 2 shows that developing (i.e. non High Income OECD) countries almost have twice as high a probability of a fiscal event occurrence than industrial countries. At the same time, developing countries are less likely to have a growth event following a fiscal event. Within the developing country group, as already noted, Latin America stands out with both the lowest probability of occurrence of a fiscal event, and the highest probability that the event is followed by a growth event.

It is instructive to compare, side by side, probabilities of a fiscal event with the probability of a fiscal event followed by a growth event. This is done in figure 2. Consider first figure 2a. It is clear that low-income countries have both a higher probability of having a fiscal event, but a lower probability of having a fiscal event followed by a growth event. Looking at it by region in figure 2b, one sees

[16] These probabilities are computed by dividing the numbers of events by the number of country-year observations in which an event could have occurred. The latter is calculated by summing all the observations in the sample and eliminating: (i) a 4-year window after the occurrence of each event since our qualifying conditions take this period as belonging to the same episode; (ii) the potential competing dates before the event that have been eliminated by the spline regression. This rule gives 977 possible occasions in which a fiscal event could have occurred, i.e. the probability of a fiscal event is: 95/977=9.7% (see table 2 col. 5) for a typical country over the full-sample period 1977-2000. Likewise, a typical country would have about 2.6% (col. 6) probability of experimenting a fiscal event followed by a growth acceleration at some point over 1977-2000. This means that the probability of growth acceleration when a fiscal event has occurred is around 26.3% (table 2, col. 8).

that this pattern is largely reflecting the distribution of fiscal and growth events in the Middle East and Sub-Saharan Africa. Suppose then that the success of a fiscal event can indeed be measured by whether or not it is followed by a growth event. One is then tempted to add that these patterns could reflect the quality of underlying institutions. Indeed, according to many indicators, Sub-Saharan Africa and the Middle East have bad scores on several indicators of institutional quality.

Note that when we use the alternative definition of fiscal event allowing Low-income countries to increase their average fiscal deficit during the fiscal spending growth period up to 4% of GDP, 3 additional fiscal events followed by a growth event are identified: Mali, Mauritius and Burkina Faso. Then, under this scenario, the probability that a fiscal event is followed by a growth event in Middle East and Africa increases from 11% to 21%.

Table 2. Fiscal event probabilities *a/*

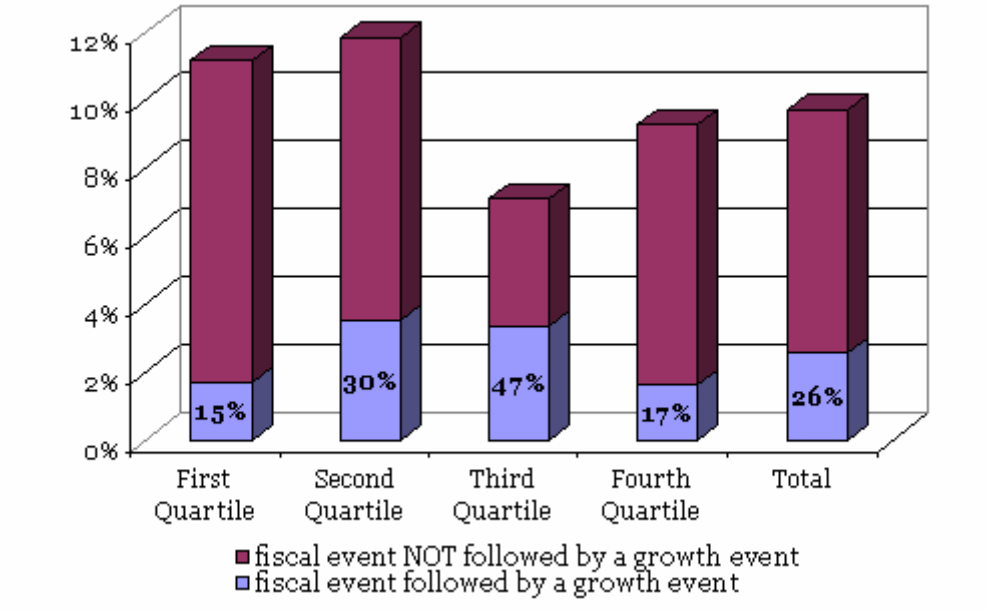
	Number of fiscal events:				**Probability of occurrence :**			Probability that a fiscal event is followed by a growth event
	Total fiscal events	followed by a growth event	NOT followed by a growth event	obs. *b/*	Total fiscal events	Fiscal events followed by a growth event	Fiscal events NOT followed by a growth event	
	(1)	(2)	(3)	(4)	(5)=1/4	(6)=2/4	(7)=3/4	(8)=6/5
Total	95	25	70	977	9.7%	2.6%	7.2%	26.3%
First GDP pc Quartile c/	26	4	22	233	11.2%	1.7%	9.4%	15.4%
Second GDP pc Quartile	27	8	19	228	11.8%	3.5%	8.3%	29.6%
Third GDP pc Quartile	19	9	10	268	7.1%	3.4%	3.7%	47.4%
Fourth GDP pc Quartile	23	4	19	248	9.3%	1.6%	7.7%	17.4%
High Income OECD countries	21	6	15	297	7.6%	2.2%	5.4%	28.6%
Developing countries	74	19	55	680	12.2%	3.1%	9.1%	25.7%
Asia	17	5	12	171	11.0%	3.3%	7.8%	29.4%
Middle East & Africa	28	3	25	198	14.1%	1.5%	12.6%	10.7%
Latin America & Carib.	20	9	11	235	8.5%	3.8%	4.7%	45.0%
Europe & Central Asia	9	2	7	76	11.8%	2.6%	9.2%	22.2%

Notes: See annex A.1.3, table A.3 for country classification in the sample.
a/ Computations based on benchmark set of parameters from table A.4, row 1 (58 growth events and 95 fiscal events).
b/ Obs. in which a fiscal event could have occurred.
c/ "First GDP pc Quartile" corresponds to "low income" and some "lower middle income" countries.
"Second GDP pc Quartile": "lower middle income" and some "upper middle income" countries.
"Third GDG pc Quartile": "high income" countries.
"Fourth GDP pc Quartile": "upper middle income" countries.

Source: Authors' computation from GFS and PWT 6.2 data, see Annex A.2

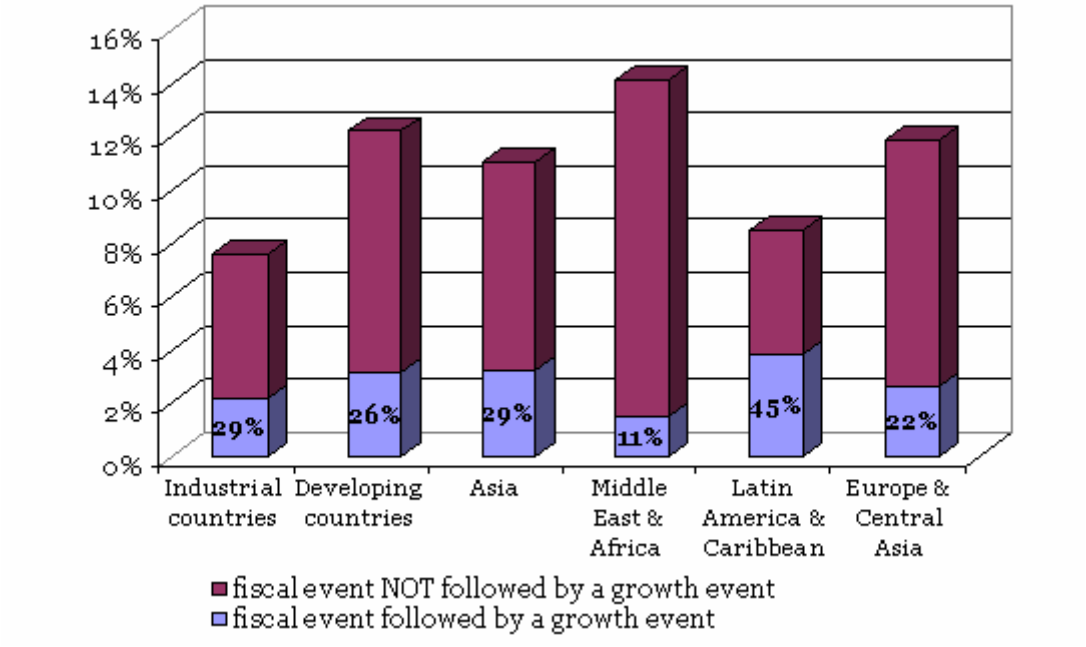
Figure 2. Fiscal and Growth event probabilities by income quartiles and regions

a. by GDP per capita Quartiles ("Fourth" is the highest)



%: probability of growth acceleration when a fiscal event has occurred

b. by regions



%: probability of growth acceleration when a fiscal event has occurred

Source: computation from Table 2, cols 5 and 8.

5. Understanding Fiscal Events:

The Anatomy of fiscal Events. The benchmark set of parameters selected 95 fiscal events. Table 3 describes the changes in the composition of fiscal expenditures around these events. The table shows average values and changes for the 5-year period preceding the event and the 5-year following the event. Table 4 gives the same information, but this time the comparison is between events that preceded a growth event and events that did not precede a growth event, focusing on "Low and Middle Income" countries.

Start with the anatomy of fiscal events in table 3. Not surprisingly, the restriction that fiscal events in deficit situations should be accompanied by a reduction in the fiscal deficit is reflected in the evolution of the fiscal deficit (reduction) between the periods preceding and following the event date. The patterns are the same for both groups of countries (i.e. High and non-High income countries), average changes (see last column) being larger for the Low and Middle Income country group. Likewise, individual changes in expenditures by functional group are larger for Low and Middle Income than for High Income countries. However, the pattern of changes for the big expenditure categories is the same for both groups of countries.

One can check if there are noticeable differences in the changes in expenditures across the two groups. Taking the whole sample and ignoring the residual category, fiscal events involve a shift towards Education, Health and Housing & Community expenditures at the expense of Defense, non-interest General Public Services, and Transport & Communication expenditures. For the Low and Middle Income country group, the three big expenditure items are (percentage of discretionary expenditures in parenthesis): non-interest Public Services (20.2%), Education (13.8%) and Defense (10.4%). Compared with the High Income events, the Low and Middle Income country events indicate a much bigger cut in non-interest public services and in defense expenditures, the latter probably capturing countries entering a post-conflict situation.

Table 3: Characteristics of fiscal events

		fiscal events (95) [a/]				
		Average level by 5-year period *(average annual growth in Italics)*				change ppa
		Pre-event period [t-n-1; t-1]		Post-event period [t;t+n]		
		(1)	(2)	(3)	*(4)*	(5)=(3)-(1)
% of public expenditure in GDP	All	25.51	*-1.33*	24.43	*0.73*	-1.08
	HIc/	29.41	*-0.85*	28.76	*0.82*	-0.65
	non HI c/	23.53	*-1.58*	22.22	*0.69*	-1.31
% of public deficit/surplus in GDP	All	-2.92	*0.79*	-0.73	*-0.32*	2.19
	HIc/	-1.94	*0.69*	-0.25	*-0.50*	1.69
	non HI c/	-3.44	*0.84*	-0.97	*-0.23*	2.46
Expenditures by function *(in % of total public exp.)*						Change % (5)=(3-1)/1
Education	All	12.54	*0.16*	13.50	*0.15*	7.7%
	HI	9.95	*-0.06*	10.17	*0.03*	2.1%
	non HI	13.80	*0.28*	15.13	*0.21*	9.7%
Health	All	7.13	*0.07*	7.50	*0.07*	5.1%
	HI	8.70	*0.01*	8.92	*-0.03*	2.5%
	non HI	6.36	*0.10*	6.80	*0.13*	6.9%
Transport & Communication	All	6.17	*-0.13*	5.46	*0.01*	-11.6%
	HI	4.83	*-0.18*	4.32	*0.01*	-10.8%
	non HI	6.80	*-0.11*	5.99	*0.01*	-11.9%
Non-interest public services	All	18.04	*-0.94*	16.78	*-0.40*	-7.0%
	HI	13.77	*-0.25*	13.64	*0.09*	-1.0%
	non HI	20.18	*-1.30*	18.35	*-0.65*	-9.1%
Defense	All	9.97	*-0.18*	8.82	*-0.06*	-11.6%
	HI	9.18	*-0.10*	8.42	*-0.15*	-8.3%
	non HI	10.37	*-0.23*	9.01	*-0.01*	-13.1%
Housing & community amenities	All	3.09	*0.09*	3.57	*0.12*	15.5%
	HI	3.03	*-0.02*	2.86	*0.18*	-5.7%
	non HI	3.12	*0.15*	3.92	*0.09*	25.9%
Recreation, culture,& religion	All	1.41	*0.01*	1.23	*0.01*	-12.8%
	HI	0.97	*0.00*	0.98	*-0.01*	0.9%
	non HI	1.62	*0.01*	1.35	*0.02*	-17.0%
Others (residual)	All	41.64	-	43.15	-	3.6%
	HI	49.55	-	50.70	-	2.3%
	non HI	37.75	-	39.44	-	4.5%

Notes: See annex A.1.3, table A.3 for country classification in the sample.
Col. 1: average over 5-year period preceding fiscal event; Col. 3: average over 5-year period after fiscal event
[a/] Based on the benchmark set of parameters (table A.4, row 1).
[b/] Average annual growth rate over the period in parenthesis
[c/] HI stands for "High-Income" countries as defined by World Bank (July 2007);
"HI" sample = 32 fiscal events, "non HI" sample = 63 events.

Source: Authors' computation from GFS and PWT 6.2 data, see Annex A.2.

Focusing on the Low and Middle Income country group, table 4 compares the evolution of functional expenditures for fiscal events followed by a growth event compared with those not followed by growth events. In particular, we look at the underlying changes of discretionary public expenditures by function.

Table 4: Characteristics of Fiscal Events in Developing countries According to Their Timing with Growth Events [a/]

	fiscal event followed by a growth event			fiscal event NOT followed by a growth event		
	14/63			49/63		
	Average level		change ppa	Average level		change ppa
	Pre-event (1)	Post-event (2)	(3) =(2)-(1)	Pre-event (4)	Post-event (5)	(6) =(5)-(4)
% of public expenditure in GDP	25.4*	24.0*	-1.4	23.0*	21.7*	-1.3
% of public deficit in GDP	-3.4	-0.3*	3.2*	-3.4	-1.2*	2.3*
Expenditures by function (in % of total public exp.)			change % =(2-1)/(1)			change % =(5-4)/(4)
Education	12.8	14.4	13%	14.1	15.3	9%
Health	8.4*	8.8*	5%	5.7*	6.2*	8%
Transport and Communication	6.4	6.6*	3%*	6.3	5.8*	-7%*
General (non interest) public services	16.5*	15.4*	-7%*	21.3*	19.3*	-10%*
Defense	6.0*	5.5*	-8%*	11.7*	10.0*	-14%*
Housing and community amenities	4.5*	4.2	-7%*	2.7*	3.9	43%*
Recreation, culture, and religion	1.5	1.0	-30%	1.7	1.4	-13%
Others (residual)	43.9	44.1	0%	36.5	38.0	4%

Notes
Developing countries are defined as low and middle income countries, see Annex A.1.3.
* Test of difference in mean between fiscal event NOT followed by a growth event compared to fiscal event followed by a growth event (i.e. col. 4, 5, 6 compared to col. 1, 2 and 3 respectively). An asterisk indicates significance at 5% level.
a/ Based on the benchmark set of parameters, see table A.4, row 2.

Source: Authors' computation from GFS and PWT 6.2 data, see Annex A.2.

First note that the level of the deficit in GDP is lower during fiscal events followed by a growth event, a result that is corroborated by the regression analysis in section 5.[17]

Three other significant differences appear when one compares the evolution of fiscal expenditure for the two groups of events. First, fiscal events followed by growth events devote fewer resources to general public services. Second, fiscal events followed by a growth event are characterized by a growing share of transport and communication expenditure whereas the pattern is the opposite when the fiscal event is not followed by a growth event. Third, though the difference in means is not statistically significant, there is a higher growth in education expenditures when the fiscal event is followed by a growth event than when it is not (and the opposite pattern holds for health expenditures).

Correlates of Growth Events. We now look for any evidence that growth events may be correlated with fiscal events using regression analysis. Our dependent variable is then a dummy that takes the value of 1 in the 3-year window around the date of growth acceleration (and 0 otherwise), the 3-year window (as in HPR) reflecting the uncertainty attached to the identification of the first year of a specific growth event.[18] The comparison group for a growth event consists of the countries that have not had a growth episode in that same 3 years. We estimate the following probit[19] where the binary dependant variable

[17] As discussed in section 3, insofar as the growth event occurs during the 5-year period when the fiscal deficit is computed, there could be a mechanical effect whereby the fiscal deficit will be lower during spells of high growth. On the other hand, the evidence for developing countries discussed in section 3 shows that fiscal expenditures and fiscal deficits are higher during periods of high growth (more capital inflows and "voracity" effects in the political cycle).

[18] Growth events are computed according to the same benchmark with 58 growth events. Because we are interested in predicting the timing of growth events, we drop all data corresponding to years $t+2...t+4$ of a growth event. The sample then consists of all countries for which the relevant data are available, including countries that have not experienced growth episodes. Given the lack of availability for terms of trade data, we use sample of 104 countries (71 "non high income" countries), over 1977-2000, and 1127 observations (706 for the "non high income" sample). Note that there are still 50 growth events (29 for "non high income" countries) and 73 fiscal events (54 for "non high income" countries) in this sample, with 22 cases of fiscal events followed by a growth event (14 for "non high income" countries). See Annex A.2.

[19] We also fit a *logit*. Both *probit* and *logit* fit maximum likelihood models with dichotomous dependent variables coded as 0/1. With a *logit* model, equation (1) would be identical except for ϕ which is the cumulative logistic distribution rather than the cumulative normal distribution. It is difficult to theoretically justify the choice between these two models. Note that the logistic distribution being very similar to the normal one, results are usually identical. However, some differences in results could appear in very unbalanced sample, i.e. in a sample in which there are many more 0s than 1s, which is our case. This is why, as a robustness check, we also present logit estimation results.

(the 3-year window around the date of the year of the growth event, ***GE$_{it}$***) is regressed on several determinants:

$$\Pr\left(GE_{it}=1\right)=\phi\left(\alpha_0+\alpha_1 FE_{it}+\alpha_2 WW_{it}+\alpha_3 TOT_{it}+\alpha_4 HI_{it}+\sum_{t-1}\beta_t D_t\right) \text{ for i=1..104; t=1..24} \qquad (1)$$

where:

ϕ is the cumulative normal distribution;

FE_{it} is a dummy variable that takes the value of 1 at the date of the fiscal event as defined in the benchmark above and during the four years following this date;

WW_{it} is a proxy for trade (and other) reforms, i.e. a dummy taking the value of 1 during the first five years of a transition towards openness as defined by WW (2003);

TOT_{it} is a proxy for any external shock, i.e. a dummy taking the value of 1 if the change in the terms of trade for country i and year t is in the upper 90% of the entire sample. Following HPR, this variable is introduced to capture exceptionally favorable external circumstances;[20]

HI_{it} is a dummy equals to one for High Income countries;

$\sum_{t-1} D_t$ is a full set of year effects.

In equation (1), the year dummies capture the effects of omitted time-related variables like common shocks across countries that could account for a growth event. As to the fiscal dummy event variable, FE_{it}, it is a way to test whether, on average, growth events are preceded by fiscal events. The inclusion of the WW_{it} dummy for trade reform is both to capture the potential growth effects of a trade reform, but also the effects of other ongoing reforms since, very often, trade reforms are part of a broader package of reforms. Finally, as pointed out by Easterly et al. (1993), it is also plausible that many growth acceleration are triggered by favorable external conditions, especially in our context where, due to the short length of time series, we defined growth events over a 5-year window.[21] To control for this, we introduce the TOT_{it} dummy.

[20] The change in the terms of trade is computed as the first difference of the log of the terms-of-trade index , the latter defined as the ratio of export prices to import prices using the current and constant price values of exports and imports from WDI. We use this index instead of the more traditional net-barter index because of its broader coverage. However, this measure has the disadvantage that it includes the service export sector (see the discussion in Loayza and Raddatz, 2007).

[21] Easterly et al. (1993) showed that about 10 percent of the variation in GDP growth and a quarter of the variation in growth volatility can be explained by the observed differences in the volatility of terms-of-trade changes.

Table 5: Probit Estimates of Growth events

Dependent variable: Dummy for the timing of growth events						
	Probit	Probit	Probit	**Probit**	Logit	Logit
Col.	(1)	(2)	(3)	**(4)**	(5)	(6)
FE_{it} *(fiscal event dummy)*	0.038**	0.045**	0.054***	**0.060*** **	0.054***	0.058**
	0.021	0.023	0.022	**0.022**	0.021	0.018
$FE_{it} * \overline{def}_{t_{FE},t_{FE}+n}$	-	-	0.019***	**0.019** **	0.017***	0.018**
			0.007	**0.009**	0.006	0.009
WW_{it} *(Trade liberal. dummy)*	-0.061**	-0.069**	-0.055*	**-0.060** **	-0.049**	-0.049**
	0.024	0.021	0.025	**0.023**	0.025	0.023
TOT_{it} *(Terms of trade dummy)*	0.129*	0.132**	0.122*	**0.121** **	0.119	0.113*
	0.086	0.080	0.084	**0.078**	0.085	0.069
DC_t *(developed-country dummy)*	0.005	-	0.007	**-**	0.006	-
	0.020		0.020		0.018	
Year effects	yes	yes	yes	**yes**	yes	yes
Sample	All	non HI	All	**non HI**	All	non HI
Obs.	1127	706	1127	**706**	1127	706
Pseudo R^2	0.08	0.10	0.9	**0.11**	0.09	0.11
observed proportion of GEit=1	12.5%	11.6%	12.5%	**11.6%**	12.5%	11.6%

Estimation by probit. Coefficients are marginal probabilities evaluated at the sample means.

Numbers below coefficients are robust standard errors. See text for definition of variables.

HI stands for "High Income" countries as defined by the World Bank, July 2007.

***, **, * indicates significant at the 1%, 5%, and 10% level respectively.

We allow for a five-year lag between a change in the underlying determinant and a growth event. The timing of the growth event is the three year window centered on the initiation dates.

Source: Authors' computation, see Annex A.2.

Before commenting on the results, one should caution about the endogeneity problems, especially of the fiscal event dummy. It could be that in country-events when growth is anticipated to be unusually high, one might think that policy-makers would increase discretionary public spending (simultaneous bias if this increase occurs with a decreasing associated deficit). Unfortunately, we lack appropriate instruments, so the results should be interpreted accordingly.

Cols. (1) and (2) in table 5 report the marginal coefficients corresponding to the estimation of (1) on the whole and on the "non high income" samples respectively. Hence, the reported coefficients give directly the change in the probability that a growth event occurs for a discrete change of the corresponding dummy variable from 0 to 1.

Col. (1) which reports estimates for *all* countries, shows that the coefficient associated with FE_{it} is significantly positive (at the 5% level) implying that, on average, a fiscal event increases the probability of experiencing a growth event in the five consecutive years by 3.8 percentage points. [22]

Turning to the variable that captures the five years following economic reform (other than fiscal) through trade liberalization, WW_{it}, surprisingly, the coefficient is significantly negative. This coefficient was also negative but not significantly in HPR. However, this surprisingly negative coefficient does not necessarily contradict WW (2003) results since when they study the timing of the growth response to trade liberalization they find that, in the 3 pre-liberalization years, growth is slightly depressed and that, in the 3 years following liberalization, the effect is not significantly different from zero. However, an increase in growth becomes noticeable (of around 1.5 percentage point) after 4 years.[23]

As expected, we observe a strong conditional correlation between external shocks and the probability of a growth event: a large positive terms-of-trade shocks increases the probability of experiencing a growth event by 12.9 percentage points (significant at a 10% level). This confirms that the incidence of external shocks and, in particular, fluctuations in the terms of trade plays an important role. Finally, the high income dummy is not significantly different from zero so that when we limit our sample to "non high income" countries (see col. 2), coefficients remains very similar.

Recent literature assessing the effects of public expenditures on growth (e.g. Kneller *et al.*, 2000, Bose *et al.*, 2003, and Adam and Bevan, 2005) has emphasized the importance of incorporating the budget constraint. Here we check whether the impact of a fiscal event on the probability of a growth event is directly correlated with the level of the associated deficit by introducing the fiscal event dummy FE_{it} interactively with its associated deficit/surplus level $\overline{def}_{t_{FE},t_{FE}+n}$ (t_{FE} being the date of the fiscal event, n=4).[24]

[22] As argued in section 3, in "non-high" income countries, evidence suggests that fiscal policy typically pro-cyclical. Hence, if a growth event occurs in the year following a fiscal event, this should increase the deficit, weakening the probability of observing fiscal events followed by a growth event.

[23] Remember that one of the conditions for a growth event in this paper is an increase in the annual growth rate of per capita GDP of at least 2 pp. Hence, if we redefine the dummy WW_{it} in order to capture the years [t+5 and more] after the trade liberalization instead of [t; t+4] as previously, we obtain a positive coefficient, though its value is not statistically significant.

[24] Of course, the fiscal deficit/surplus situation is implicitly already taken into account as one of the conditions defining what we call a "Fiscal event" is that a deficit situation must improve.

Results reported in col. (3) and (4) show that the associated coefficient is significantly positive (at 1% level) indicating that the marginal impact of a fiscal event depends on both coefficients (associated to FE_{it} and $FE_{it} * \overline{def}_{t_{FE}, t_{FE}+n}$).

This means that the probability of occurrence of a growth event in the 5 years following a fiscal event is greater the lower the associated fiscal deficit, confirming the prima facie appropriateness of fiscal policy as a stabilizing device. It would however, be premature to read into these results that there may not be a trade-off between the stabilization and growth objectives of fiscal policy, since omitted variables correlated with the regressors are likely to influence these results. Coefficient values associated with WW_{it} and TOT_{it} remain unchanged.

To ease interpretation, table 6 reports for a typical Low and Middle Income country, the impact of a fiscal event on the occurrence of a growth event for different values of the associated deficit/surplus. As indicated in the table, for a typical Low or Middle Income country and in the absence of a fiscal event in the five preceding years, the probability of a growth event is around 7.8%.[25] This probability is quite similar in case of a fiscal event with an associated fiscal deficit equals to 3% of GDP (only 0.06 percentage point of difference).[26] The probability of a growth event increases to 9.6% in case of a fiscal event in a deficit situation of 2% of GDP, and reaches 16.9% in a surplus situation of 1%, implying an increase in growth event probability of 9.1 percentage point compared to the no-fiscal-event alternative. Remember that to be qualifying as fiscal event this deficit can not increase with public expenditure.

[25] Based on results in table 5, col.(4) with $FE_{it} = 0$, all other variables set at their sample mean.

[26] Based on results in table 5, col.(4) with $FE_{it} = 1$, all other variables set at their sample mean.

Table 6: Interpretation of Probit Model Results [a/]

	No Fiscal Event	Fiscal Event associated with an average deficit of:				
		-3%	-2%	-1%	0%	1%
Probability of occurrence of a growth event in the 5 following years b/	7.8%	7.8%	9.6%	11.8%	14.2%	16.9%
Change in growth event probability from a no fiscal event situation		0.06 pp	1.9 pp	4.0 pp	6.4 pp	9.1 pp

Note: *pp* stands for percentage points.
a/ Evaluation based on coefficients of the equation reported in column 4, table 5.
b/ Evaluation of $\phi\left(\alpha_0 + \alpha_1 FE_{it} + \alpha_1 FE_{it} * def_{t_{FE},t_{FE}+n} + \alpha_2 \overline{WW}_{it} + \alpha_3 \overline{DC}_{it} + \sum_{t-1} \beta_t \overline{D}_t\right)$
for different values of FE_{it} and $def_{t_{FE},t_{FE}+n}$, all other variables evaluated at their sample mean, ϕ representing the standard cumulative normal distribution.

Source: Authors' computation from table 5, col.4.

Finally, table 7 reports statistics of the predictive ability of this Probit model. It is customary to take a prediction rule with a threshold value is p* = 0.5, on the basis that we would predict a 1 if the model says a 1 is more likely than a zero :

$\hat{GE}_{it} = 1$ if the predicted probability $\hat{\phi} >$ p*

However, because of the unbalanced sample with many more 0s than 1s, we set p* equal to the proportion of 1's in the sample (which corresponds to the average predicted probability in the sample).

Taking this criterion, table 7 suggests that the basic model as defined in table 5, column (4), successfully predicts 78% of the growth events (i.e. GE_{it}=1) and 62.3% of total cases of no growth events (i.e. GE_{it}=0). Hence, 64.2% of total growth event observations are correctly predicted. Since this measure of goodness of fit depends on the cutoff selected to classify the predicted $\hat{GE}_{it}$, one should only interpret the results in table 7 as indicative orders of magnitude.

Table 7: Prediction Accuracy of the Probit Model [a/]

Share of actual GE_{it} predicted by the model
(share in total observation in parenthesis)

		actual			
		GE=1		GE=0	
Predicted	GE=1	78.0%	*(9.1%)*	37.7%	*(33.3%)*
	GE=0	22.0%	*(2.5%)*	62.3%	*(55.1%)*
	Total	100.0%	*(11.6%)*	100.0%	*(88.4%)*

Correctly classified = 64.2%

a/ computation based on coefficients reported in column 4 in table 5 , cutoff =11.6% (value for determining whether an observation has a predicted positive outcome).

Source: Authors' computation from table 5, col.4.

We carry out two robustness checks. First, as discussed above, we estimate a logit function (which has fatter tails and may be more appropriate for our sample with many zero values for the dependent variable). Results in columns (5) and (6) of table 5 show that the logit specification does not change the qualitative conclusions based on results in col. (3) and (4). Second, we change the definition of FE_{it} with the dummy that takes the value of 1 at the date of the fiscal event and during the 9 years following this date (instead of 4). This alternative, which gives more time for the effects of a fiscal event to have an impact on growth, does not alter qualitatively the estimates.

6. Conclusions

This paper constructs growth and primary spending expenditures (i.e.net of interest payments) "events" over the period 1972-2005 for 118 developing and 22 High Income OECD countries. Fiscal expenditures were compiled by Government function, and "events" were sought over 5-year rolling windows with a missing observation attributed if less than 4 out of 5 years of data were available. For the growth episodes, data was available for 87% of the potential of 6171 observations. For the fiscal episodes, data was available for 40% of the potential 4760 observations. In spite of more than half of the potential observations missing for the construction of fiscal events, in the end, the search for events was based on a sufficiently large data base allowing for statistical tests.

Significant "events" were approximately constructed as follows (see section 3 and annex A.3 for details). For GDP per capita, acceleration in the average annual growth rate of 2 percentage point per annum (ppa) between any rolling 5-year window would qualify for a growth "event". For fiscal expenditures (expressed in GDP%), an increase in the average growth rate of approximately 1 ppa that would not be accompanied by an aggravation of the (consolidated central government) fiscal deficit beyond 2% of GDP would likewise qualify for a fiscal "event". The resulting benchmark constructed data set (merging both fiscal and growth databases) had 58 growth events and 95 fiscal events over a sample included 107 countries (84 developing countries) over 1977-2000 (1452 observations).

For this sample, the (unconditional) probability of occurrence of a fiscal event is about 10%, and, for a large range of parameter values for the selection of a "significant" event, the probability of a growth event once a fiscal event had occurred is in the 22%- 28% range. The probability of occurrence of a fiscal event is higher for the bottom half of the income distribution of countries, but the probability that this fiscal event is followed by a growth event is higher for the third quartiles, corresponding to middle income countries (which are largely in Latin America). Finally, the probability of a fiscal event *not* followed by a growth event is significantly higher for the Middle East and Africa region, prompting us to note that this result is coherent with the view (taken by the interim report presented to the Development Committee, 2006) that the success of a growth-oriented fiscal expenditure package hinges on the quality of the institutional environment.

For both "High income" and "Low and Middle Income" countries, fiscal events involve a shift towards education, health and Housing & Community expenditures at the expense of defense, non-interest Public Services, and Transport & Communication expenditures, the shifts always being larger for developing countries, confirming more volatility (and probably a lesser

stabilization role of fiscal policy since the data cover a medium-term horizon). In particular, the Low and Middle Income country events indicate a much bigger cut in non-interest public services and in defense expenditures, the latter probably capturing countries entering a post-conflict situation.

Concentrating on the Low and Middle Income sample of 84 countries, the paper also investigates the differences in the pattern of functional expenditures for fiscal events followed by growth events compared to those not followed by a growth event. In addition to a significantly lower fiscal deficit for fiscal events followed by a growth event (which is partly an outcome of the way events were constructed), three other significant differences appear. First, fiscal events followed by growth events devote fewer resources to general public services. Second, fiscal events followed by a growth event are characterized by a growing share of transport and communication expenditure whereas the pattern is the opposite when the fiscal event is not followed by a growth event. Third, though the difference in means is not statistically significant, there is a higher growth in education expenditures when the fiscal event is followed by a growth event than when it is not.

This description of the anatomy of fiscal events and their relation to growth events is completed by statistical analysis where a few controlling factors are included in a probit estimate of growth events on fiscal events. On average, we find that a growth event is more likely to occur when surrounded by a fiscal event. Second, controlling for the growth-related effects of other reforms (captured by the Wacziarg-Welch indicator) and for favorable external conditions shocks (better terms-of-trade), we estimate that for a typical developing country, the probability of occurrence of a growth event in the five years following a fiscal event is increased as the associated fiscal deficit is limited.

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ANNEXES

Annex A.1 explains the construction of the "fiscal" database from which fiscal events are computed. Annex A.2 presents the database used to compute the growth events and the final database that results from the merge of the "fiscal" and "growth" databases.

A.1. Fiscal Database
A 1.1. Definition of Variables and Conversion of 1986 GFS data into the 2001 GFS format.
A.1.2. Data Consistency Check for the Change in GFS series.
A.1.3. Sector and Data Availability in the Fiscal Database.
A.2 Consolidated Database
A.3. Fiscal and Growth Events: Definitions and Sensitivity Analysis

A.1. FISCAL DATABASE

To define the fiscal event, we use the IMF Government Financial Statistics (GFS) database. GFS is the main data source for most empirical cross-country studies on government expenditures. The reason for its popularity is that it is the only database offering comparable data on public expenditure for a large sample of countries in the world including many developing countries. As noted by Estache et al. (2006), "this does not mean that the data are good" (see Estache et al. 2006 pages 6-7 for a survey on the main problems with these data). Keeping these limitations in mind, we are able to compute the notion of a fiscal event as defined in body of the paper.

Annex A.1.1 reports in details the definition of the fiscal variables used in the study with notably the classification of expense by function of Government according to the GFS manual 2001. Because there was a major change in the data series between 1989 and 1990 when the definition of variables in the GFS changed, we also explain in detail in annex A.1.1 the conversion of 1986 GFS data (i.e. the GFS system that covers data from 1972 to 1989) into the 2001 GFS format (i.e. GFS system that covers data from 1990 to 2004) for our budgetary variables, i.e., Total Revenue, Total expense (or outlays), and the decomposition of outlays by functions.

Because there was this major change in the data series between 1989 and 1990, we also checked if there was a break in the converted series of interest for this study. The box plots are reported in **Annex A.1.2.** To our relief, figure A1 does not indicate a break in the series around 1989-1990 justifying our keeping this year in the sample.

Finally, the countries/years with available data on total revenue, total expenditure, and disaggregated expenditure by function are reported in **Annex A.1.3**, table A3. We use data at the consolidated central government sector level and at the budgetary central government level if the former is not available. Then the "fiscal" database used in the study includes the 140 countries (including 22 High income OECD countries) listed in table A1 and extends over 1972-2005. This amounts up to 1904 observations for each variable.

Note that Tables 1, A2, A3 and Figures A1 reported in this study are computed on this "fiscal" database.

A.1.1. Definition of Variables and Conversion of 1986 GFS data into the 2001 GFS format.

GFS 1986 data are by definition on a cash basis. Hence, we complete data with GFS 2001 data in the "Statement of sources and Uses of Cash" (and not in the "statement of Government Operations", recorded on an accrual basis). Box A.1(a) gives a description of the Statement of sources and Uses of Cash as defined in the GFS manual (GFSM) 2001.

BOX A.1: Classification of GFSM 2001.

(a) Statement of sources and uses of cash:

Cash flows from operating activities:

1 Cash receipts from operating activities
11 Taxes
12 Social contributions
13 Grants
14 Other receipts

2 Cash payments for operating activities
21 Compensation of employees
22 Purchases of goods and services
24 Interest
25 Subsidies
26 Grants
27 Social benefits
28 Other payments

Net cash inflow from operating activities

Cash flows from investments in nonfinancial assets:

31.1 Purchases
311.1 Fixed assets
312.1 Strategic stocks
313.1 Valuables
314.1 Nonproduced assets

31.2 Sales
311.2 Fixed assets
312.2 Strategic stocks
313.2 Valuables
314.2 Nonproduced assets

Net cash outflow from investments in nonfinancial assets

Cash surplus/deficit

1) Classification of the Function of Government.
2) By sector of the counterparty to the financial instrument.
Source: GFSM 2001.

(b) The classification Coding system for GFS:

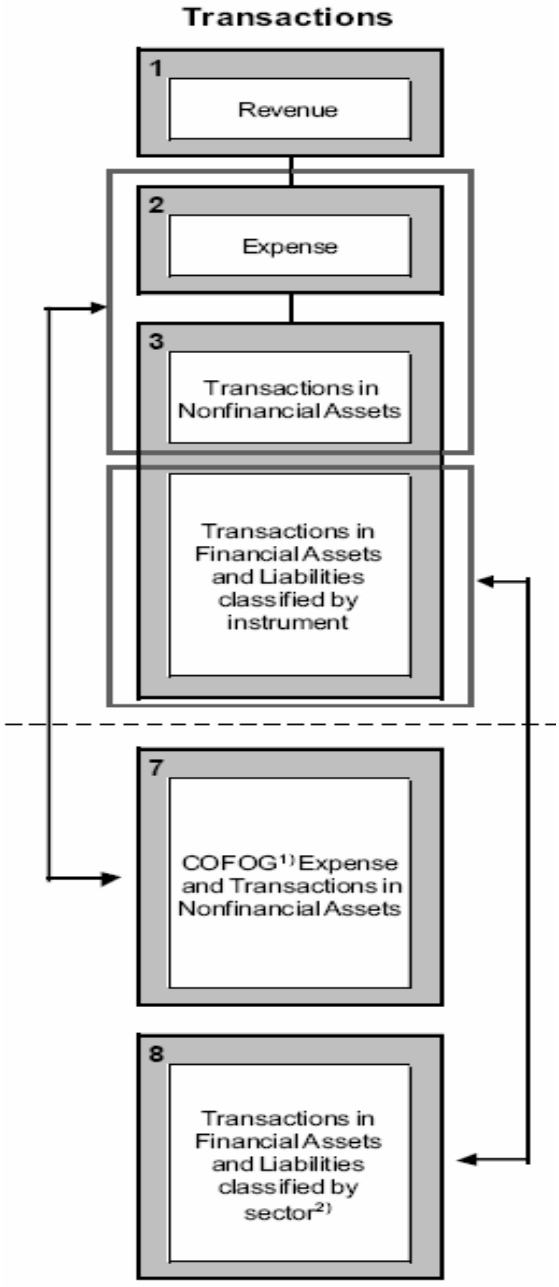


Table A.1 report the conversion of 1986 GFS data into the 2001 GFS format for our budgetary variables, i.e., Total Revenue, Total expense (or outlays), and the decomposition of outlays by functions. The classification of functions of Government (COFOG) is a detailed classification of the functions, or socioeconomic objectives, that general government units aim to achieve through various kinds of outlays. This classification has been published by the United Nations and has been revised. The GFSM 2001 incorporates the revised COFOG (reported in Box A.2) and table A.1 takes also into account the correspondence between different COFOG versions.

Box A.2: Classification of expense by Function of Government

7	**Total outlays**
701	**General public services**
7011	Executive and legislative organs, financial and fiscal affairs, external affairs
7012	Foreign economic aid
7013	General services
7014	Basic research
7015	R&D[1] General public services
7016	General public services n.e.c.[2]
7017	Public debt transactions
7018	Transfers of a general character between different levels of government
702	**Defense**
7021	Military defense
7022	Civil defense
7023	Foreign military aid
7024	R&D Defense
7025	Defense n.e.c.
703	**Public order and safety**
7031	Police services
7032	Fire protection services
7033	Law courts
7034	Prisons
7035	R&D Public order and safety
7036	Public order and safety n.e.c.
704	**Economic affairs**
7041	General economic, commercial, and labor affairs
7042	Agriculture, forestry, fishing, and hunting
7043	Fuel and energy
7044	Mining, manufacturing, and construction
7045	Transport
7046	Communication
7047	Other industries
7048	R&D Economic affairs
7049	Economic affairs n.e.c.
705	**Environmental protection**
7051	Waste management
7052	Waste water management
7053	Pollution abatement
7054	Protection of biodiversity and landscape
7055	R&D Environmental protection
7056	Environmental protection n.e.c.
706	**Housing and community amenities**
7061	Housing development
7062	Community development
7063	Water supply
7064	Street lighting
7065	R&D Housing and community amenities
7066	Housing and community amenities n.e.c.
707	**Health**
7071	Medical products, appliances, and equipment
7072	Outpatient services
7073	Hospital services
7074	Public health services
7075	R&D Health
7076	Health n.e.c.
708	**Recreation, culture, and religion**
7081	Recreational and sporting services
7082	Cultural services
7083	Broadcasting and publishing services
7084	Religious and other community services
7085	R&D Recreation, culture, and religion
7086	Recreation, culture, and religion n.e.c.
709	**Education**
7091	Pre-primary and primary education
7092	Secondary education
7093	Postsecondary nontertiary education
7094	Tertiary education
7095	Education not definable by level
7096	Subsidiary services to education
7097	R&D Education
7098	Education n.e.c.
710	**Social protection**
7101	Sickness and disability
7102	Old age
7103	Survivors
7104	Family and children
7105	Unemployment
7106	Housing
7107	Social exclusion n.e.c.
7108	R&D Social protection
7109	Social protection n.e.c.

[1]R&D = Research and development.
[2]n.e.c. = not elsewhere classified.

source: GFSM 2001, page 76

Table A.1. Conversion of 1986 GFS data into the 2001 GFS format (*Source: Authors based on GFSM 2001 and 1986*)

		2001 GFS CLASSIFICATION			1986 GFS CATEGORY		IMF DATABASE CODE(S)	
Revenue	=	**1**	**Cash Receipts from operating activities** (taxes, Social contribution, Grants, others Receipts including nontax revenue)	=	**A.I**	**Total revenue and grants** (tax and nontax revenue, Grants, and Capital revenues including the sales of nonfinancial assets i.e. sales of fixed capital assets, stocks, and land and intangible assets -A13.; A14.; A15.)	1 =	81...zg
	+	**31.2**	**Sales of nonfinancial assets** (Fixed assets, Strategic stocks, Valuables, Nonproduced assets)					
	=	**7**	**Total outlays**	=	**B.I**	**Total expenditure**	7 =	82..zg
			2 cash payments for operating activities (Compensation of employees, Purchases of goods and services, Interest, Subsidies, Grants, Social Benefits, Other payments)	(=C.II)		(Expenditure on goods and services including Compensation of employees, Interest, Subsidies, Capital expenditure including the purchases of nonfinancial assets i.e. Acquisition of fixed capital assets, stocks, and land and intangible assets - C4.; C5.; C6.)		
			31.1 Purchases of nonfinancial assets (Fixed assets, Strategic stocks, Valuables, Nonproduced assets)					
Expenditure	=	**701**	**General public services** (Executive and legislative organs, financial and fiscal affairs, external affairs, Foreign economic aid, General Services, Basic Research, R&D General public services, Public debt transactions, others)	=	B1.	General public services	701 =	82a..zg +
				+	B14.	Expenditures not classified by major group		82k..zg
		7017	*Public debt transactions*	*B14.0.1*		*Expenditure on interest payments*	*7017 =*	*82pa.zg*
	+	**702**	**Defense** (Military defense, Civil defense, Foreign military aid, R&D defense, others)	+	B2.	Defense affairs and services	702 =	82b..zg
	+		**Transport and Communication**	+	B12.	Transport and Communication		
		7045	Transport (Road, Water, Railway, Air, Pipeline and others)				7045+	82hi.zg
		7046	Communication				7046 =	*
	+	**706**	**Housing and community amenities** (Housing and Community development, Water supply, Street lighting, R&D , others)	+	B7.	Housing and community amenity affairs and services	706 =	82f..zg
	+	**707**	**Health** (Medical products, appliances, and Equipment, Outpatient services, Hospital services, Public health services, R&D health, others)	+	B5.	Health affairs and services	707 =	82d..zg
	+	**708**	**Recreation, culture, and religion** (Recreational and sporting services, Cultural services, Broadcasting and publishing services, Religious and other community services, R&D, others)	+	B8.	Recreational, cultural, and religious affairs and	708 =	82g..zg
	+	**709**	**Education** (Pre-primary and primary, Secondary, Postsecondary nontertiary, Tertiary Education, Subsidiary services to educations, R&D, others)	+	B4.	Education affairs and services	709 =	82c..zg
	+		**Others**					
		703	Public order and safety		B3.	Public order and safety affairs	703 =	82ac.zg
		704	Economic affairs (others than Transport and Communication)		B9-	Economic affairs	704 =	82h..zg-

		13				82hi.zg
705	Environmental protection	B7.3	Sanitary affairs and services	705 =		*
710	Social protection	B6.	Social security and welfare affairs and services	710 =		82e..zg

See the GFS Manual 2001 "Classification of GFSM 1986 data to the GFSM 2001 Framework", October 2002 for a full explanation.

* Not separately available from, or does not exist, in the 1986 GFS classifications.

According to the GFS manual (GFSM) 2001, COFOG is applied to government expense and the ***net*** acquisition of nonfinancial assets. In total, these are referred as government outlays (see box A1). With this definition, the GFSM 1986's category of Total expenditure (category B.I) is only a proxy for total outlays (category 7) because Total expenditure includes expenses plus the acquisition of nonfinancial assets and no details exist in GFSM 1986 to classify the sales of fixed assets, stocks, and land and intangible assets (categories A.13, A14, A15) to the GFSM 2001/COFOG categories.[27]

However, observation of the data in the GFSM 2001 framework reveals that total outlay is still equal--on a cash reported basis--to "cash payments for operating activities + purchases of nonfinancial assets" (column 1 in table A2: 56 cases out of 77 correspond to this definition in 1995) instead of "operating activities + net cash outflow from investment in nonfinancial assets" assets"(column 2 in table A2: 1 case out of 77 corresponds to this definition).

Table A2. Computation of "Total Outlays" in the GFSM 2001 data for 1995 and 2000

year	(1)	(2)	(3)	(4)	
1995	56	1	12	8	77
	73%	1%	16%	10%	100%
2000	24	9	7	6	46
	52%	20%	15%	13%	100%

(1) Case 1: Outlays= cash payments for operating activities + purchases of nonfinancial assets
(2) Case 2: Outlays= cash payments for operating activities + net cash outflow in nonfinancial assets
(3) Status quo: both cases 1 and 2 are correct as sales on nonfinancial assets are nil.
(4) Both cases 1 and 2 are not correct, but case 1 is always clearly closest to the correct amount of outlays.

Source: authors' computation, Computed on available data for the Budgetary Central government, from the "statement of sources and uses of cash" and the "outlays by functions of governments, GFS 2001 CD-ROM

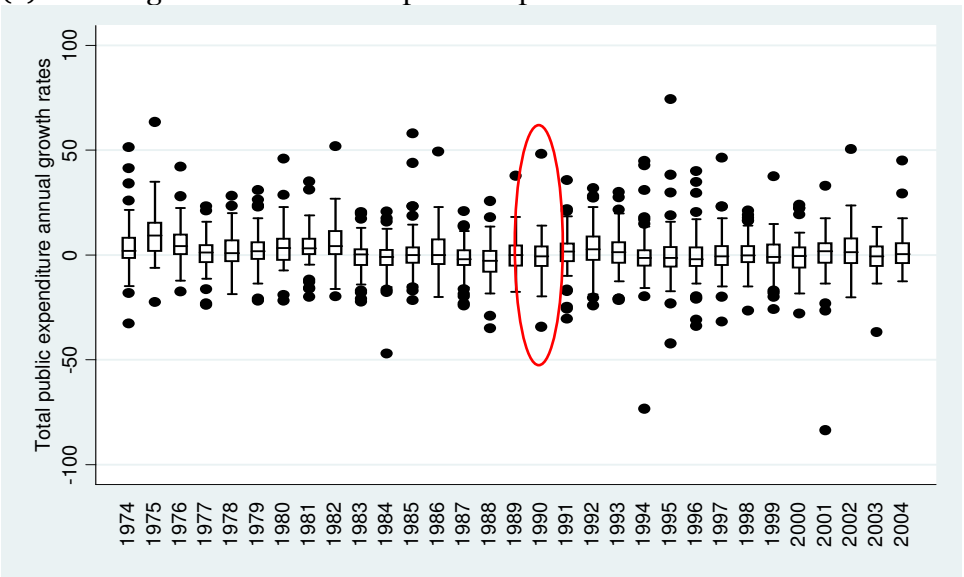
Hence, we take into account this definition of total outlays in GFSM 2001 and adapt the table of the GFSM 1986 conversion as reported in Table A.1, i.e. with the purchase of nonfinancial assets included in Total outlays and sales in nonfinancial assets included in Total Revenue, in both GFSM 1986 and 2001. Note that whatever the definition of outlays and revenue, the overall Deficit/surplus are still defined as Outlays minus Revenue, i.e. the net cash inflow from operating activities minus the net cash outflow from investment in "nonfinancial assets".

[27] See pages 18-19, Classification of GFSM 1986 Data to GFSM 2001 framework, October 2002.

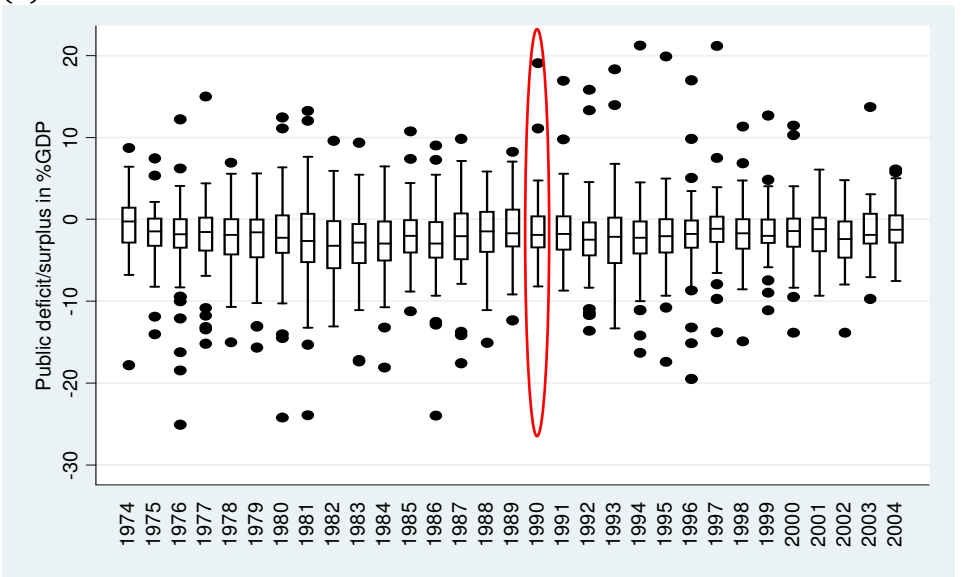
A.1.2. Data Consistency Check for the Change in GFS series.

Figure A.1. Data consistency check for the change in GFS series (check for break in the data between 1989 and 1990)

(a) Annual growth rate of total public expenditure in GDP

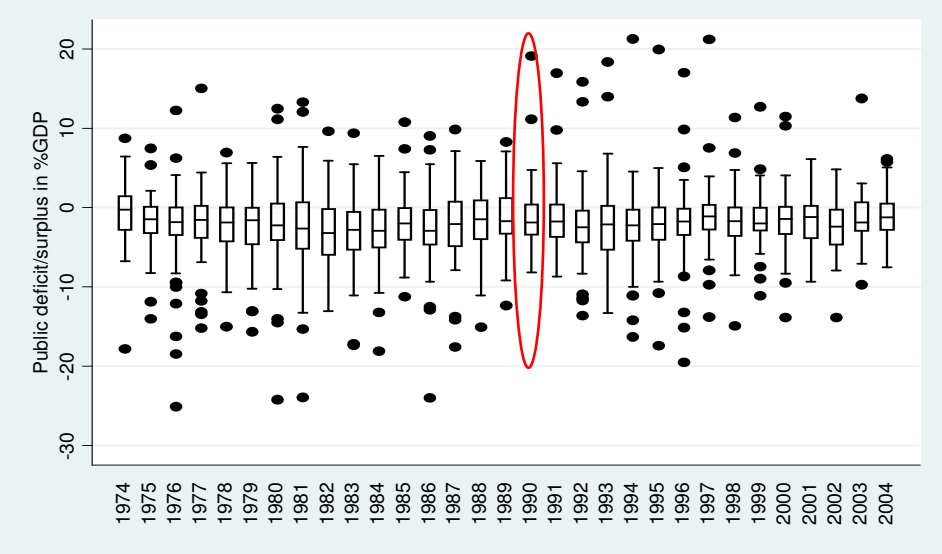


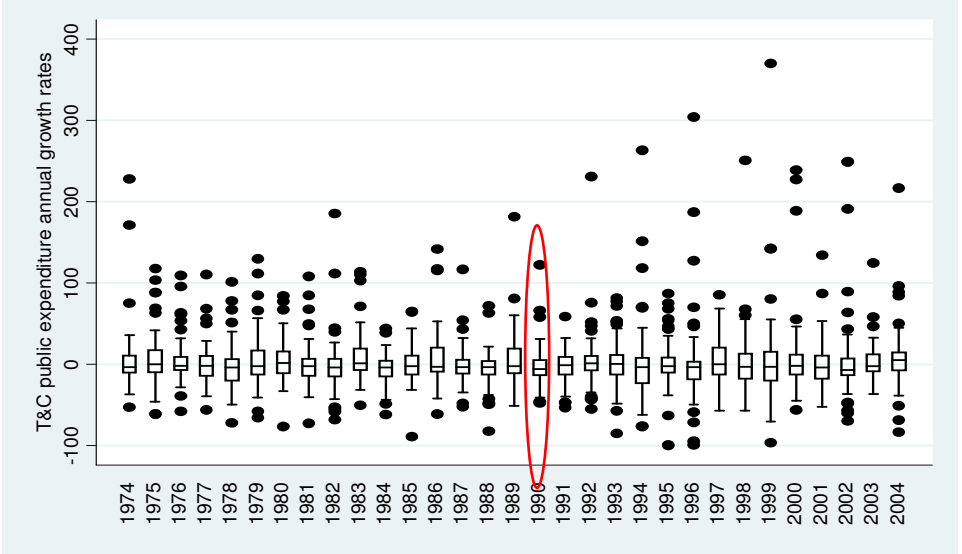
(b) Public deficit in GDP



(c) Annual growth rate of Education expenditure in total public expenditure

(d) Annual growth rate of Transport and Communication expenditure in total public expenditure





Source: Authors' computation from GFS data.

A.1.3. Sector and Data Availability in the Fiscal Database

Finally, Table A3 defines the sample used to compute the fiscal event. We keep only the countries/years for which data are available, on a *cash basis of recording*, on total revenue, total expenditure, and disaggregated expenditure by function i.e. expenditure in General public services / Public debt transaction/ Defense/ Transport and Communication / Housing and Communities / Health / Recreation, Culture and Religion/ Education / Others (see definition in details in Annex A.1.1).

We use data at the consolidated central government sector level (CG) and at the budgetary central government level (BA) if the former is not available over the studied period. For each country included in the fiscal database (see column 1), we indicate in column 4 the corresponding government level we use. Note that 73% of the countries have fiscal variables reported at the CG level which corresponds to 86% of the observations.

For each country, the maximum number of observations is 34 (from 1972 to 2005). We report in column (2) the number of observations actually available for each country. On average, by country, the GFS database includes only 14 years over the 34 potential ones (40%). We also indicate in column (5) and (6) the first and last years available, and if the series within this period is continuous (in which case there are zero missing value) or if some years are missing (and if so how many). This information is in column 7.

The resulting "fiscal" database used in the study then includes the 140 countries (including 22 High Income OECD countries) over 1972-2005 with 1904 observations (which represents 40% of the potential number of observations, 140*34=4760).

Note that for OECD countries, data in recent years are rarely available. This is due to the fact that these countries have recently changed from a cash to an accrual basis of recording with no possible conversion.

Table A.3. Fiscal Sample

Country	Country Code	# Obs	Reported Sector a)	Available years b)		Missing Values
				First	Last	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
High Income OECD countries						
AUSTRALIA*	193	27	CG	1972	1998	0
AUSTRIA*	122	23	CG	1972	1994	0
BELGIUM*	124	17	CG	1972	1988	0
CANADA*	156	32	CG	1974	2005	0
DENMARK	128	28	CG	1972	1999	0
FINLAND*	172	26	CG	1972	1997	0
FRANCE*	132	19	CG	1975	1993	0
GERMANY*	134	23	CG	1972	1994	0
GREECE*	174	10	CG	1972	1981	0
ICELAND*	176	26	CG	1972	1997	0
IRELAND*	178	13	CG	1982	1994	0
ITALY*	136	14	CG	1973	1988	2
JAPAN*	158	3	CG	1991	1993	0
LUXEMBOURG*	137	24	CG	1972	1995	0
NETHERLANDS*	138	21	CG	1974	1994	0
NEW-ZEALAND	196	11	BA	1991	2001	0
NORWAY*	142	26	CG	1972	1999	2
SPAIN*	184	22	CG	1972	1994	1
SWEDEN*	144	28	CG	1972	1999	0
SWITZERLAND*	146	25	CG	1972	2002	6
UNITED-KINGDOM*	112	28	CG	1972	1999	0
UNITED-STATES*	111	29	CG	1972	2000	0
Developing countries						
AFGHANISTAN	512	3	BA	2003	2005	0
ALBANIA	914	7	BA	1995	2004	3
ALGERIA	612	6	BA	1994	1999	0
ARGENTINA	213	30	CG	1972	2001	0
AZERBAIJAN	912	6	CG	1994	1999	0
BAHAMAS*	313	16	BA	1990	2005	0
BAHRAIN*	419	32	CG	1974	2005	0
BANGLADESH	513	4	BA	2001	2004	0
BARBADOS*	316	18	CG	1972	1989	0
BELARUS	913	13	CG	1992	2005	1
BELIZE	339	8	BA	1990	1997	0
BENIN	638	3	CG	1977	1979	0
BHUTAN	514	21	CG	1982	2004	2
BOLIVIA	218	15	CG	1987	2001	0
BOTSWANA	616	7	BA	1990	1996	0
BRAZIL	223	19	CG	1972	1998	8
BULGARIA	918	18	CG	1988	2005	0

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Country	Country Code	# Obs	Reported Sector a)	Available years b)		
				First	Last	Missing Values
BURKINA-FASO	748	15	CG	1973	1989	2
BURUNDI	618	11	CG	1973	1996	13
CAMEROON	622	13	CG	1976	1994	6
CENTRAL-AFR.-REP.	626	1	CG	1981	1981	0
CHILE	228	15	CG	1972	1986	0
CHINA,P.R.	924	13	BA	1990	2004	2
CHINA-MACAO	546	3	CG	1996	1998	0
COLOMBIA	233	8	BA	1990	1997	0
COMOROS	632	1	CG	1984	1984	0
CONGO-DEM-REP-OF	636	17	CG	1972	1997	9
CONGO-REPUBLIC-OF	634	2	CG	1982	1983	0
COSTA-RICA	238	29	CG	1972	2003	3
CROATIA	960	15	BA	1991	2005	0
CYPRUS*	423	26	CG	1972	1997	0
CZECH*	935	13	CG	1993	2005	0
DOMINICAN-REPUBLIC	243	29	CG	1973	2004	3
ECUADOR	248	1	BA	1990	1990	0
EGYPT	469	22	CG	1975	1997	1
EL-SALVADOR	253	12	BA	1990	2001	0
ESTONIA*	939	11	CG	1991	2001	0
ETHIOPIA	644	12	BA	1990	2002	1
FIJI	819	9	BA	1990	2005	7
GAMBIA	648	1	BA	1990	1990	0
GEORGIA	915	9	CG	1997	2005	0
GHANA	652	8	BA	1990	2004	7
GUATEMALA	258	11	BA	1990	2005	5
HONDURAS	268	8	CG	1972	1979	0
HUNGARY	944	19	CG	1981	1999	0
INDIA	534	28	CG	1977	2004	0
INDONESIA	536	31	CG	1973	2004	1
IRAN	429	33	CG	1972	2005	1
ISRAEL*	436	28	CG	1972	1999	0
JAMAICA	343	6	BA	2000	2005	0
JORDAN	439	16	BA	1990	2005	0
KAZAKHSTAN	916	9	CG	1997	2005	0
KENYA	664	14	BA	1991	2004	0
KOREA, REP.* c)	542	30	CG	1972	2005	4
KUWAIT*	443	23	CG	1972	1999	5
KYRGYZ	917	9	BA	1993	2001	0
LATVIA	941	12	CG	1994	2005	0
LEBANON	446	4	CG	1993	1996	0
LESOTHO	666	16	CG	1972	2004	17
LIBERIA	668	15	CG	1974	1988	0
LITHUANIA	946	8	BA	1993	2000	0

Country	Country Code	# Obs	Reported Sector a)	Available years b)		
				First	Last	Missing Values
MADAGASCAR	674	12	CG	1972	1997	14
MALAYSIA	548	18	CG	1972	1995	6
MALDIVES	556	27	CG	1979	2005	0
MALI	678	8	CG	1976	1988	5
MALTA	181	26	CG	1972	1998	1
MAURITIUS	684	33	CG	1973	2005	0
MEXICO	273	29	CG	1972	2000	0
MOLDOVA	921	10	CG	1996	2005	0
MONGOLIA	948	10	CG	1992	2002	1
MOROCCO	686	24	CG	1972	1999	4
MYANMAR	518	30	CG	1973	2002	0
NAMIBIA	728	3	BA	2001	2003	0
NEPAL	558	33	CG	1972	2005	1
NETHERLANDS-ANTILLES*	353	24	CG	1972	1995	0
NICARAGUA	278	14	CG	1972	1994	9
NIGER	692	5	CG	1976	1980	0
OMAN	449	12	BA	1990	2001	0
PAKISTAN	564	8	CG	1998	2005	0
PANAMA	283	29	CG	1973	2001	0
PAPUA-NEW-GUINEA	853	13	BA	1990	2002	0
PARAGUAY	288	17	CG	1972	1989	1
PHILIPPINES	566	16	BA	1990	2005	0
POLAND	964	7	CG	1994	2000	0
ROMANIA	968	22	CG	1980	2001	0
RUSSIA	922	3	CG	1999	2001	0
SENEGAL	722	6	CG	1975	1984	4
SEYCHELLES	718	13	CG	1993	2005	0
SIERRA-LEONE	724	1	BA	1990	1990	0
SINGAPORE*	576	33	CG	1972	2004	0
SLOVAK	936	7	CG	1996	2002	0
SLOVENIA*	961	13	CG	1993	2005	0
SOUTH-AFRICA	199	4	BA	1995	2003	5
SRI-LANKA	524	16	BA	1990	2005	0
ST.-KITTS-AND-NEVIS	361	3	CG	1985	1987	0
ST.-VINCENT-&-GRENADINES	364	2	BA	1990	1993	2
SUDAN	732	2	BA	1998	1999	0
SURINAME	366	6	CG	1972	1986	9
SWAZILAND	734	2	BA	1999	2000	0
SYRIAN-A.-REP.	463	24	CG	1972	1999	4
TAJIKISTAN	923	4	CG	1998	2001	0
TANZANIA	738	11	CG	1972	1985	3
THAILAND	578	31	CG	1972	2002	0
TONGA	866	10	CG	1980	1989	0
TOGO	742	7	CG	1977	1987	4

Country	Country Code	# Obs	Reported Sector a)	Available years b)		
				First	Last	Missing Values
TRINIDAD-&-TOBAGO*	369	13	CG	1976	2004	16
TUNISIA	744	34	CG	1972	2005	0
TURKEY	186	25	CG	1972	1998	2
UGANDA	746	3	BA	2001	2003	0
UKRAINE	926	5	CG	1999	2005	2
UNITED-ARAB-EM.*	466	3	BA	1997	1999	0
URUGUAY	298	25	CG	1972	2000	4
VANUATU	846	13	CG	1981	1997	4
VENEZUELA	299	6	CG	1999	2005	1
WEST-BANK-AND-GAZA	487	1	BA	2005	2005	0
YEMEN	474	10	BA	1990	1999	0
ZAMBIA	754	10	BA	1990	1999	0
ZIMBABWE	698	19	CG	1976	1997	3

* means that corresponding countries are classified as a High Income country, i.e. with a 2006 GNI per capita (calculated using the World Bank Atlas method) greater than $11,116, Classification of July 2007

a) Government sectors: CG Central Government (consolidated)/ BA Budgetary Central Government
For EU countries listed, in line with the presentation adopted within the European Union, data on BA operations may include the operations of extra-budgetary units/entities.

b) Reports the first and last years available, and if the series within this period is continuous (zero missing value) or if some years are missing (and how many).

c) High income and Signed the Convention founding the OECD in December 1996 but mainly non OECD over the studied period.

Source: Authors' computation from GFS data.

A.2. CONSOLIDATED DATABASE

The consolidated database is obtained by merging the fiscal database with the growth event database discussed below.

To compute the growth event, we use the Penn World Table PWT 6.2 as our baseline data source. As in HPR 2005 (who use PWT 6.1 over 1950-1999), we eliminate all countries with fewer than 15 data points. Hence, the "growth" database covers 187 countries over the same period as the "fiscal database", i.e. 1972-2004. It includes 5380 observations which amounts to 87% of the potential number of observations (=6171=187 countries*33 years).

Once the fiscal and growth events have been computed on their respective databases, we merge the two into a final dataset. This data set includes 107 countries (84 developing countries), over 1977-2000. This leads to 1452 observations which is 57% of the potential number (=2568=107 countries*24 years).

Tables 2, 3, 4, A1 and Figures 1 and 2 reported in the main text are computed on this database.

For the probit estimation, since we drop all data corresponding to years *t+2*...*t+4* of a growth event and due to the lack of availability for the terms of trade variable, the sample we use for estimating equation (1) included 104 countries (71 "non high income" countries), over 1977-2000, and 1127 observations (706 for the "non high income" sample). Note that there are still 50 growth events (29 for "non high income" countries) and 73 fiscal events (54 for "non high income" countries) in this sample, with 22 cases of fiscal events followed by a growth event (14 for "non high income" countries).

Tables 5, 6 and 7 are computed on this smaller database.

A.3. FISCAL AND GROWTH EVENTS: DEFINITIONS AND SENSITIVITY ANALYSIS

For both growth and fiscal expenditures, the detection of events takes place over a horizon, n, across variables. The objective is to examine the change in the indicator value, $z_{t,n}$, centered over that horizon (GDP growth or some component of public expenditures), that is $\Delta z_{t,n} = z_{t,t+n} - z_{t,t-n}$. Then, as in event analysis, and more particularly in HPR (2005), we impose several conditions on the change in value that variable must satisfy for an event to have taken place, the criteria each time being selected somewhat arbitrarily in order to yield enough "events" while respecting what would appear as "common sense" criteria.

Growth acceleration. We start with growth which is more familiar. We follow quite closely HPR, though, for reasons explained below, we define duration periods differently. HPR use the following criteria: (i) an increase in per-capita growth of 2 percentage points or more (percentage points per annum, ppa), (ii) growth sustained for at least eight years *[t;t+7]*, (iii) an average growth rate at least 3.5 percent per year during the acceleration period (n) and (iv) a post-acceleration output exceeding the pre-episode peak level of income. Finally, HPR use a spline regression to detect which year gives the highest structural break in growth in the relevant window horizon (8 years in the case of HPR). Because our times series for fiscal data is shorter, we will use a shorter time-period to define the growth episodes (n=4 instead of 7).

The set-up is the following. Taking a general notation, our criterion is GDP per capita growth at time t over horizon t to $t+n$,. i.e. $g_{t,t+n}$ defined by the following:

$$\ln(y_{t+i}) = a + g_{t,t+n} * i, \quad i = 0, \cdots, n \tag{2}$$

and the change in the criterion function is given by the change in the estimated (by Ordinary Least Square, OLS) growth rate over horizon n across that horizon:

$$\Delta g_{t,n} = \hat{g}_{t,t+n} - \hat{g}_{t-n-1,t-1} \tag{3}$$

An acceleration of growth will be identified when, during rapid growth episodes, the following conditions are all satisfied:

$$\begin{aligned} &\hat{g}_{t,t+n} \geq \alpha \ ppa \quad growth\ is\ rapid \\ &\Delta g_{t,n} \geq \beta \ ppa \quad growth\ accelerates \\ &y_{t+n} \geq \max\{y_i\}, i \leq t \quad post-growth\ output\ exceeds\ pre-episode\ peak \end{aligned} \tag{4}$$

where ppa is percentage points per annum, α is minimum per capita growth that must be satisfied during the period (3.5 ppa for HPR and for us in our base case) and β is the minimum acceleration that must be satisfied (2.0 ppa for HPR and for us in our base case).

Since several years of events could be following one another, the timing of the initiation of the growth acceleration episode is chosen by fitting for each candidate year the following spline regression:

$$\ln(y_{t+i}) = a_0 + g_{t-n-1,t+n} * i + a_1 DE + vg_{t+i,t+n} * i * DE, \quad i = -n-1, \cdots, n \quad (5)$$

where DE is a dummy variable that takes a value of 1 for the candidate event year. Equation (5) is estimated by OLS over each candidate year, and the selected event year is the one for the regression with the highest F-test (i.e. highest R^2).

Fiscal events. From the GFS data (see the annex to the paper for a more precise definition of variables), define primary expenditures as total fiscal expenditures less interest payments, i.e. as $DFE = TFE - IP$.
Next, we wish to take into account the budget constraint and find a way of controlling for spending increases in situations of growing deficits. Then, the central government budget constraint (small case variables represent variables expressed as a share of GDP, i.e. $dfe = DFE / GDP$) is:

$$trg \equiv dfe + ip + def \quad (6)$$

with *trg* the total revenue and grants in % of GDP,[28] and *def* the fiscal deficit/surplus in % of GDP.[29]

Using the same notation as above to define the length over which changes in the ratio of primary spending takes place:

$$(dfe_{t+i}) = a + dfe_{t,t+n} * i, \quad i = 0, \cdots, n \quad (7)$$

An acceleration in primary spending will be identified when there is an increase in the estimated growth of ratio of primary expenditures as a percentage of GDP, Δdfe. For an acceleration to qualify as an 'event', one must control for the evolution of the deficit when there is one (again keep in mind that the deficit here is from the GFS and only includes the central government). Define now $\overline{def}_{t,t+n}$ as the average deficit (as a percentage of GDP) over the period so that the change in deficit between two adjacent periods is

$$\Delta def_{t,n} \equiv \overline{def}_{t,t+n} - \overline{def}_{t-n-1,t-1} \quad (8)$$

[28] See detailed definition in annex A.1.
[29] *def*<0 is defined as a deficit and *def*>0 a surplus.

We impose two criteria for an increase in ratio of primary expenditures growth, Δdfe, to qualify as a fiscal "event". The first criterion deals with situations when the increase in expenditures takes place from a situation of fiscal deficit. Take then the case of a fiscal deficit in the period preceding the candidate fiscal event and let δ be the selected threshold value for the central government deficit. In our sample, for developing countries, the average (central government) fiscal deficit was 2%. So, if increasing primary expenditures take place from a situation of deficit, i.e. when $\left(\overline{def}_{t-n-1,t-1} < \delta\right)$, we require an improvement in the fiscal deficit of λ (with $\lambda = 0$ corresponding to a situation of no deterioration) . This gives rise to the condition on the second line of (9).

$$\begin{aligned} &\Delta dfe_{t,t+n} \geq \phi,\ \phi > 0 \quad \textit{discretionary expenditure growth is rapid} \\ &\begin{cases} \Delta def_{t,n} \geq \lambda \ \textit{ if } \ \overline{def}_{t-n-1,t-1} < \delta \ \textit{ a deficit situation must improve} \\ \overline{def}_{t,t+n} \geq \gamma \ \textit{ if } \ \overline{def}_{t-n-1,t-1} > \delta \ \textit{ a limit on a growing deficit} \end{cases} \end{aligned} \qquad (9)$$

In the case of a more favorable initial situation (i.e. $\left(\overline{def}_{t-n-1,t-1} > \delta\right)$), we wish to exclude events where the shift to a deficit results in an average deficit in excess of γ during the period $(t, t+n)$. This is the criterion in the third line of (9) .

A numerical example inspired from the selection of events discussed below will give an idea of plausible values for the parameters of interest. For the developing countries in the sample, average primary government expenditures were about 24% of GDP over the period 1972-2000. Take $n = 4$, i.e. regressions over a five year period. Suppose that primary expenditure ratio was constant over the previous five year period. Then, if we choose $\phi = 1$ as the cut-off point to define an 'acceleration', to qualify expenditures would have had to increase by at least 4 percentage points during the 5-year period, i.e. increased to 28%.[30]

Sensitivity analysis. Recall from the main text that the objective is to end up with a "sufficient'" number of events that at the same time satisfy "reasonable" inclusion criteria. In a first step we selected parameters for growth events (essentially those of the preferred or "baseline" HPR selection, except for the 'window' length) . More concretely, in equations (4) we choose $\alpha = 0.035; \beta = 0.02; y_{t+n} \geq \max\{y_i\}$. To qualify as an "event", growth during the 5-year window has to be at least equal to 3.5 ppa and the difference in growth between the two 'windows' has to exceed 2.0 ppa. Call the resulting growth event set, the benchmark growth events. As indicated in table A.4, row 1, this yields 58 growth events.

[30] If previous period had an annual change of x—which could be negative--then there will be an event if acceleration is equal to x+4.

To obtain the corresponding benchmark fiscal events, we started with the above benchmark growth parameter set and experimented with several sets of plausible parameters for the fiscal conditions defined in equation (9). We settled for the following fiscal parameter set $\phi = 0.01; \lambda = 0; \gamma = -0.02; \delta = 0$ which yields 95 fiscal events (table A.4, row 1).

Under this set of parameter values, a fiscal event satisfies the following conditions over the relevant windows. First, an acceleration in the annual average growth rate of primary expenditures of 1 ppa. In addition, the cut-off point for deficit is set at zero (i.e. $\delta = 0$). Then in a situation of initial deficit, any increase in primary expenditures cannot be accompanied by an increase in deficit ($\lambda = 0$) . And, in a situation of initial surplus, an increase in primary expenditures cannot lead to a deficit in excess of 2% of GDP over the period ($\gamma = -0.02$).

An inspection of the sensitivity analysis results in table A.4 does not lead to particularly surprising results since tighter conditions always lead to less qualifying events. Interestingly, however, the ratio of fiscal events followed by a growth event remains in the 22%-28% range, except when we have imposed that the fiscal event is throughout accompanied by a fiscal *surplus* in which case 41% of fiscal events are followed by a growth event (row 8). Likewise, rows 9-13 carry out similar sensitivity analysis for the growth event parameters.

Finally, note that if we define periods of 8 years instead of 5 (n=7), the benchmark set of parameters leads to 52 fiscal events and 18 growth events over the reduced period 1980-1997.

Table A.4: Benchmark Events and Sensitivity Analysis

	Total number of events in		**Growth events preceded by a fiscal event**		**Fiscal event**										
					followed by a growth event		*including the ones simultaneous to growth events*		*Also preceded by a growth event*		**only preceded by a growth event**		**w/o any growth event**		Total
	Growth	Fiscal													
	(1)	(2)	(3)	**(3)/(1)**	(3)	**(3)/(2)**	(4)	(4)/(2)	(5)	(5)/(2)	(6)	**(6)/(2)**	(7)	**(7)/(2)**	(3)+(6)+(7)/(2)
Benchmark Growth Event - unchanged $(\alpha = 0.035; \beta = 0.02; y_{t+n} \geq \max\{y_i\})$															
Fiscal Event conditions:															
1. $\phi = 0.01; \lambda = 0; \gamma = -0.02; \delta = 0$	58	95	25	**43.1%**	25	**26.3%**	*6*	*6.3%*	*7*	*7.4%*	23	**24.2%**	47	**49.5%**	100%
2. $\phi = 0.005; \lambda = 0; \gamma = -0.02; \delta = 0$	58	123	28	**48.3%**	28	**22.8%**	*6*	*4.9%*	*6*	*4.9%*	29	**23.6%**	66	**53.7%**	100%
3. $\phi = 0.02; \lambda = 0; \gamma = -0.02; \delta = 0$	58	49	14	**24.1%**	14	**28.6%**	*4*	*8.2%*	*1*	*2.0%*	11	**22.4%**	24	**49.0%**	100%
4. $\phi = 0.02; \lambda = 0; \gamma = -0.02; \delta = -0.02$	58	95	25	**43.1%**	25	**26.3%**	*6*	*6.3%*	*6*	*6.3%*	24	**25.3%**	46	**48.4%**	100%
5. $\phi = 0.01; \lambda = -0.02; \gamma = -0.02; \delta = 0$	58	107	27	**46.6%**	27	**25.2%**	*7*	*6.5%*	*6*	*5.6%*	26	**24.3%**	54	**50.5%**	100%
6. $\phi = 0.01; \lambda = 0.01; \gamma = -0.02; \delta = 0$	58	81	23	**39.7%**	23	**28.4%**	*5*	*6.2%*	*4*	*4.9%*	19	**23.5%**	39	**48.1%**	100%
7. $\phi = 0.01; \lambda = 0; \gamma = -0.02; \delta = 0$; $ge_{t,t+n} > 0$	58	87	21	**36.2%**	21	**24.1%**	*3*	*3.4%*	*8*	*9.2%*	22	**25.3%**	44	**50.6%**	100%
8. $\phi = 0.01$; $\overline{def}_{t,t+n} \geq 0$	58	37	15	**25.9%**	15	**40.5%**	*3*	*8.1%*	*4*	*10.8%*	10	**27.0%**	12	**32.4%**	100%
Fiscal Event condition unchanged $(\phi = 0.01; \lambda = 0; \gamma = -0.02; \delta = 0)$															
Growth Event conditions:															
9. $\alpha = 0.035; \beta = 0.02; y_{t+n} \geq \max\{y_i\}$	58	95	25	**43.1%**	25	**26.3%**	*6*	*6.3%*	*7*	*7.4%*	23	**24.2%**	47	**49.5%**	100%
10. $\alpha = 0.02; \beta = 0.02; y_{t+n} \geq \max\{y_i\}$	74	95	31	**41.9%**	31	**32.6%**	*5*	*5.3%*	*9*	*9.5%*	27	**28.4%**	37	**38.9%**	100%
11. $\alpha = 0.035; \beta = 0.01; y_{t+n} \geq \max\{y_i\}$	70	95	28	**40.0%**	28	**29.5%**	*6*	*6.3%*	*9*	*9.5%*	25	**26.3%**	42	**44.2%**	100%
12. $\alpha = 0.02; \beta = 0.01; y_{t+n} \geq \max\{y_i\}$	95	95	33	**34.7%**	33	**34.7%**	*6*	*6.3%*	*14*	*14.7%*	30	**31.6%**	32	**33.7%**	100%
13. $\alpha = 0.035; \beta = 0.02;$	72	95	29	**40.3%**	29	**30.5%**	*6*	*6.3%*	*6*	*6.3%*	25	**26.3%**	41	**43.2%**	100%

Source: Authors' computation from GFS and PWT 6.2 data.